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VETERINARY MEDICINE

NOVEMBER 1940

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CONTENTS

Former Chief of Army Veterinary Service Dies.....602
Streamlined Cavalry 602
National Defense Example Set by Veterinarians.....603
New Army Meat Ration.....604
The Bang's Disease Eradication Project.....605
New U. S. Standards for Milk Products.....606
Relation of White Scour to Vitamin A Deficiency.....607
Tularemia—History, Incidence, Pathology, Prevention..608
Mistaken Diagnoses 609
The Newspapers Say—.....610
Army Food Inspection in the World War.....612
Small Doses of Phenothiazine Effective.....616
Animal Parasites and Parasitism.....618
Samples for Laboratory Examination.....625
Agreement Between Extension and Veterinary Services.629
The 1940 Veterinary Short Course at Auburn, Ala.....630
Allantoin and Cod-Liver Oil in Wound Treatment.....632
Moldy Corn Poisoning in Horses.....636
The Calcium-Phosphorus Ratio in the Ration of Horses..640
A Blood Protozoan Infection in Turkeys.....649
Some Observations on Bots.....654
Prolonged Milk Fever Cases—Osteomalacia.....657
Purchase Poultry According to the Grade.....658
An Embryonal Adenosarcoma of the Kidney.....659
Abnormal Parturition 660
Copulation after Spaying.....660
Estrum in the Cat.....661
"Heart Failure" in a Dog.....662
Acute Alcoholism in Dogs.....663
Abstracts 664-667
Value of the Periosteum in Bone Grafting, 664; Bang's Disease Eradication, 664; Immunologic Properties of Rabies Vaccine, 665; The Control of Trichinosis, 665; Treatment of Mange in Animals, 666; Effect of Mineral Oil on Calcium and Phosphorus Metabolism, 667; Prevention of Conception in Bitches by Injections of Estrone, 667.
Book Reviews 668
Veterinary Surgery Notes; Care of the Dog; Dutch Vet; Proceedings of the Kansas Veterinary Medical Association.

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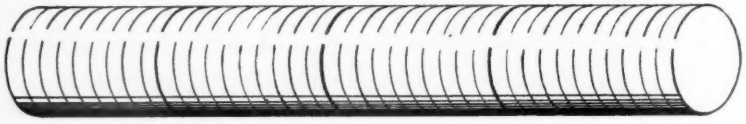

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Young rats, only 30 days of age, were made to reproduce at twice the rate of mature rats by the injection of mare gonadotropic hormone. One young rat bred three days after receiving an injection of eight rat units of gonadotropic hormone gave birth to 23 living offspring although still immature in body size. Subsequently she raised four other litters of 13, 10, 10 and 14, respectively.

* * * *

Armstrong, Wallace and Ross of the U. S. Public Health Service concluded as a result of an extensive study in Washington that the ordinary gray house mouse (*Mus musculus*) is the natural reservoir for the virus of lymphocytic choriomeningitis and is a source, perhaps the usual source, of the disease in man.

* * * *

For many years attempts have been made to educate the public regarding methods of producing and handling milk and the value of milk in the diet. Much good publicity has resulted, and occasionally harmful publicity, not always reliable, has had its effect on formulating the public's ideas as to what to expect in the milk they buy. As a result of such education, the intelligent housewife today expects the milk she buys to be clean, safe, nutritious, of good flavor, and cheap enough to allow her to buy the family's theoretical requirement. — *Ohio Agr. Exp. Sta. Bull.* 203.

Beavers in Wyoming are seriously affected by tularemia (rabbit fever), and two human cases of the disease have been traced to handling infected carcasses.

* * * *

As a result of investigations at the Public Health Service Laboratory at Hamilton, Mont., two more species of animals, muskrats and field mice, were added to the already long list susceptible to tularemia.

* * * *

Ice bags on the forehead (in man) cool the brain 1.5°F. at a depth of two inches. Ice bags on the calf of the leg lower the temperature 26°F. within the muscles of the leg. A cold draft on the calf lowers the temperature of the same muscles 11°F. Cold applied to the abdomen influences the internal viscera although it affects their temperature but little.

* * * *

The number of foreign medical publications received in the United States has been seriously curtailed by the war. The American Medical Association reports that its last big shipment of continental medical journals was received May 27th. Since then, out of a list of some 1,400 different periodicals on the Association's subscription list, only 10 stray copies have been received. British publications continue to arrive, though usually somewhat delayed. Veterinary publications are still received only from Sweden, Italy, Jugoslavia and Great Britain.

Former Chief of Army Veterinary Service Dies in San Diego Hospital

Col. Walter Fraser, former Chief of the Veterinary Division, Office of the Surgeon General, died September 27th in the naval hospital at San Diego, Calif.

Col. Walter Fraser, V.C. (1872-1940)

Walter Fraser was born in Iowa June 16, 1872. He was graduated from the Chicago Veterinary College in 1900, and received his army appointment January 29, 1903, serving with the 13th Cavalry for 13 years. He attained the rank of first lieutenant in 1917 and of colonel in 1929.

He saw active service in Mexico at the time of Villa's raid in 1916, and in France 1918-1919, as Division Veterinarian of the 85th Division and later Chief Veterinarian of the Advanced Section. As a result of his World War service he received the order of the Black Star from the French government.

On April 18, 1930, Col. Fraser succeeded Col. W. George Turner as Chief of the Veterinary Division, Office of the Surgeon General. When his four-year tour of duty there was completed in 1934, he was transferred to the Presidio of San Francisco, California. He was retired September 30, 1934.

The United States Army had in December, 1939, a total of 24,531 horses and mules. In 1938 Germany was said to have 100,000 horses and 2,000 mules in active service in the Army, and many horses have been bought from neighboring nations during the past two years. Some 4,000 cavalry horses and 2,000 artillery horses were purchased by the French government in the United States soon after the outbreak of the war.

* * * *

Streamlined Cavalry

The reorganization of the Army's cavalry divisions "to keep abreast of recent developments in transportation, weapons and mobility," just announced by the War Department, makes extensive changes in that branch of the military service and brings it into line with comparable units of the present German army.

The strength of the cavalry division is raised from 500 officers and 8,500 enlisted men to approximately 600 officers and 9,500 enlisted men, and the number of motor vehicles is raised from 350 to 800.

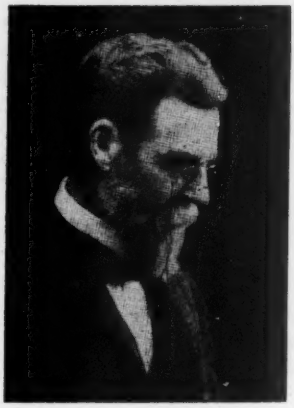
The greatest change, however, is in fire power, which has been largely augmented in the new organization. The new cavalry division will contain 715 machine guns, 268 antitank guns of small caliber, 649 submachine guns, 36 of the 37mm antitank guns, 24 of the 75mm howitzers, 12 of the 105mm howitzers, 28 mortars, 9,500 pistols and 4,000 semiautomatic rifles.

The number of horses and mules will be reduced from 8,000 under the old organization to approximately 5,800 in the new.

The Veterinary personnel will consist of the following: Division Veterinarian's Office: 1 major, 1 captain and 2 enlisted; Veterinary Troop: 1 captain, 3 lieutenants and 61 enlisted; Cavalry Regiments, each: 3 officers (captains or lieutenants) and 14 enlisted; Field Artillery Regiment: 2 officers (captains or lieutenants) and 10 enlisted; Quartermaster Squadron: 1 officer (captain or lieutenant) and 3 enlisted; a total of 21 officers and 132 enlisted men. Under the old organization the veterinary service of a cavalry division comprised 16 officers and 130 enlisted men.

National Defense Example Set by Veterinarians 61 Years Ago

John R. Mohler, Chief of the Bureau of Animal Industry, U. S. Department of Agriculture, recently recalled how current national defense activities were foreshadowed 61 years ago when James Law, a veterinarian, urged the National Congress that the United States defend her possessions from disease enemies as well "as the less insidious one who attacks us openly with fire and sword." Doctor Mohler cited the incident in an address September 19th in Philadelphia, on the occasion of the Bicentennial Celebration of the University of Pennsylvania.



PROF. JAMES LAW (1838-1921)

James Law was born in the county of Edinburgh, Scotland, February 13, 1838. A graduate of the Dick Veterinary College of Edinburgh in 1857, he studied also at the Alfort and Lyon veterinary colleges in France. He was associated with Gamgee on the faculty of the New Veterinary College at Edinburgh, later at the Albert Veterinary College, London, and in the writing of a veterinary anatomy. In 1868 he came to Cornell University to head the Veterinary Department and became consulting veterinarian for the New York State Agricultural Society. He was veterinary editor of the New York Tribune and the Live Stock Journal for many years, and contributed many articles to other periodicals. Soon after coming to America he published *The Farmer's Veterinary Adviser*, and later a textbook of five volumes on *Veterinary Medicine*. He served on the U. S. Treasury Cattle Commission and on the New York State Commission on Tuberculosis in Cattle, and in the eradication of contagious pleuropneumonia by the B. A. I. in 1887. When the New York State Veterinary College was organized at Cornell University in 1896, he became director and held this position until retiring in 1908 after 51 years spent in veterinary education. He was president of the A. V. M. A. 1906-07. He died May 10, 1921.

Delving into the history of veterinary science, Doctor Mohler, an alumnus of the University of Pennsylvania, reviewed the benefits which increasing mastery over animal diseases has contributed to human welfare. Among the benefits have been contributions to human medicine and to industrial development, and many cases of effective cooperation between the Federal government and the states.

It was on the importance of strong, central authority to provide national security, however, that Doctor Law set the example of foresighted statesmanship quoted in Doctor Mohler's Philadelphia address. Referring to pleuropneumonia, which had invaded the United States and was ravaging its herds, Doctor Law said in 1879: "It matters little whether controlled by state or national government, if vigor and uniformity of action can be secured; but since much combined and unflagging work is necessary, it could be best controlled by an intelligent, central authority. The United States Government is as much called upon to defend her possessions against an enemy like this—so implacable, so relentless—as against the less insidious one who attacks us openly with fire and sword. Let the National Congress consider this well." Congress heeded the admonition, in which other veterinarians joined, and in a few years that disease enemy was destroyed and has never returned.

Continuing in the same vein Doctor Mohler pointed out that "every country has a right to protect itself by appropriate measures against disease known to be present in other countries. This is in harmony with the fundamental law of self-preservation." Delegates to the International Veterinary Congresses have agreed on such self-protection as a fundamental point in wise national administration. At the same time, veterinary officials of different countries cooperate in acquainting each other with the essential information on the presence of disease dangers, thereby aiding each country to develop sound policies for the protection of its animal wealth and assurance of an adequate food supply for its inhabitants.

While man is easily infected by the bovine type of tuberculosis, infection with human type bacilli does not cause significant lesions in cattle. It may, however, sensitize them to the tuberculin test.

New Army Meat Ration

A new field ration for the Army has been developed at the Subsistence Research Laboratory of the Quartermaster Depot at Chicago. It is designed for use when the regular garrison or field ration is not available or cannot be prepared. The new ration is called the type "C" field ration; is packed in sealed containers and consists of two units, one of meat and one of bread. The meat unit includes three products—meat and beans, meat and vegetable stew, and meat and vegetable hash. The meat consists of beef or pork, and only that processed in plants under the supervision of the Bureau of Animal Industry, U. S. Department of Agriculture, may be used.

Components of the three meat units are as follows:

	Pct. or lbs. per 100 lbs.
MEAT AND VEGETABLE STEW:	
Beef	50
Potatoes	15
Carrots	15
Beans, dry	10
Tomato juice (or pulp)	10
MEAT AND VEGETABLE HASH:	
Beef	40
Pork	10
Potatoes	46
Onions	4
MEAT AND BEANS:	
Beef	25
Pork	25
Beans, dry	25
Tomato juice (or pulp)	25

To each 100 lbs. of these ingredients, the following seasoning ingredients are added:

	Oz.
Salt	18.5
Celery salt	6
Pepper, white	1
Sugar, white, granulated	30

The meat must be lean with fat and fibrous material removed and of good quality. Bull meat and oily pork are not acceptable. The vegetables must comply with U. S. official standards.

Nearly two million cans of the meat unit have already been contracted for from various packers.

There are 76 medical schools in the United States and Canada. In the past year 5,703 received the M.D. degree. One out of 20 of the graduates were women. Medical students, not including interns, numbered 24,194.

Twenty-two patients in the Bellevue Hospital, New York, received a total of 78 injections of aminophyllin for severe bronchial asthma, according to a report by Henry A. Carr, M.D. Twenty gave almost immediate favorable response. Two responded less favorably. Eight, or 36%, were long standing asthmatics who had been treated with the usual adrenalin injections, but whose attacks persisted unabated. Twelve persons received aminophyllin alone for their present attack with almost immediate favorable response. All cases were to varying degrees refractory to adrenalin.

A grave nervous ailment in silver foxes, seriously interfering with power of movement and ending fatally in a large proportion of cases, has been traced by R. G. Green of the University of Minnesota and C. A. Evans of the U. S. Biological Survey to a diet containing too much fish. The disease is basically a vitamin B_1 deficiency. Ranchers who feed their foxes a diet containing 10% or more of fish are inviting trouble, according to Doctors Green and Evans.

Hemorrhagic Septicemia

Hemorrhagic septicemia apparently accounts for heavy losses in some bunches of feeder lambs. This disease usually develops during the first two weeks after the arrival of the lambs at the farm. Many of the lambs that are first affected die within 24 hours. Symptoms are dullness, discharge from eyes and nose, coughing, and sneezing. Cases that develop more slowly may terminate in typical pneumonia. Isolation of the sick lambs and good care are often effective in checking the progress of the disease. Vaccination appears to be helpful in certain outbreaks and ineffective in others. Best results can be expected when the lambs are vaccinated before the disease appears in the flock.—*Animal Pathology & Hygiene Division, University of Illinois, Urbana.*

The Bang's Disease Eradication Project

The Bang's disease eradication plan launched in 1934 is a bloody business. It is distasteful to the veterinary profession because its members hate to admit that after a four- or five-year course in scientific veterinary medicine the best thing they can do is to say, "Kill 'em." After all these years and the expenditure of untold millions of dollars the test and slaughter method of bovine brucellosis control remains an experiment. It is yet to be demonstrated that it is a practical means of controlling the infection in an ordinary commercial dairy district. That it will clean a herd of the infection has been shown amply. That it will do it without cleaning out the herd and taking the owner to the cleaners as well is not so certain.

The owner of a herd from which the disease has been eradicated has the feeling of sitting on a keg of powder with smokers all about. It is not conducive to sound sleep. That in part accounts for the enormous difference in the number of herds given the first test and the number retested.

The desideratum in bovine brucellosis control is to prevent virulent organisms gaining access to susceptible cattle. The result is the same whether the parasite is smothered or the host rendered unsusceptible. In view of the many and uncontrollable sources of infection the latter seems the simpler and the more desirable. For a decade calfhood vaccination has given promise of preventing the infection from reaching susceptible animals. To date there is no record of its failure; a thing that can't be said for the bloody test-and-slaughter method. Purely as a face-saving proposition, many devotees of the blood creed are now proposing that calfhood vaccination be combined officially (much of the success of the test-and-slaughter plan has been due to the unofficial, *sub rosa* combination of these plans) with the bloody plan. It is a good idea. The blood test won't harm the animals and the owner can be depended upon to slaughter unprofitable animals whether they are tested or not. However, calfhood vaccination too is an experiment. Unfortunately no sufficiently large-scale tests of it have been made. Further, with the possible exception of B. C. G., heretofore no vaccine has ever proved effective against a chronic ailment—that, if nothing else, imposes caution in hoisting its standard. The B.A.I. vaccine test now underway gives promise at present of answering the question as to the value of calfhood vaccination. It should have been undertaken earlier.

Veterinary medicine will win approbation for conserving, not for killing animals. It should be wary of plans calling for it to exercise the role of butcher. Sometimes that role is wisest, but it should be the last resort and undertaken only when there is no other that promises success. It should never be made, as has been done in the brucellosis control project, the preferred plan. It is only good practice to choose the less radical operation, the less severe medicament, the less drastic measure, of those that appear feasible, in conservation of animal wealth.

* * * *

Year-Around Turkey Marketing

Turkey raising has been increasing rapidly in recent years. The amount of turkeys in storage on August 1 of this year (29,530,000 lbs.) was more than double that of only a year ago. Much interest is being shown in the industry in plans for promoting year-around consumption of the meat of this native American bird. Among the most promising of such plans is the production of cured meat such as is available in hams, bacon or corned beef. It appears to have been attained experimentally in a smoked product.

The skill, refrigeration and equipment required for the production of smoked turkey makes it a packing house process. It is too complicated for the turkey raiser. The carcasses are first given a brine cure and since the breasts and legs and wings cure at different rates, brine must be injected into the dark meat. The cure requires three days and the smoking six to eight hours at 160°F. Hickory or oak sawdust or green applewood produces a satisfactory smoke flavor.

Recent research (*Vet. Med.*, Feb., 1940, pp. 103-105; May, 1940, p. 318; July, 1940, pp. 398-400) will reduce the cost of producing turkeys and contribute to the year-around use of turkey meat.

New U. S. Standards for Milk Products

U. S. Standards of identity have been promulgated for cream, evaporated milk, condensed milk, plain and sweetened, and whipping cream by Secretary of Agriculture Wallace, becoming effective September 30. Meanwhile the food and drug administration, under the jurisdiction of which the standards lodge, has been transferred to the Federal Security Administration, under Paul V. McNutt.

Dried skim milk, powdered skim milk, skim milk powder.—The food made by drying sweet skim milk. It contains not more than 5% moisture, as determined by the method prescribed in "Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists," fourth edition, 1935, page 282, under the caption "Moisture—Tentative." The term "skim milk" as used herein means cows' milk from which the milk fat has been separated.

Dry milk, immediately after processing, contains about 3% of moisture, it is pointed out but if packaged and marketed according to accepted commercial methods, the moisture content should not rise above 5%.

Cream.—The sweet fatty liquid or semi-liquid separated from milk, with or without the addition thereto and mixed therewith of sweet milk or sweet skim milk. It may be pasteurized and if it contains less than 30% of milk fat as determined by the method hereinafter referred to, may be homogenized. It contains not less than 18% of milk fat, as determined by the method prescribed in Official and Tentative Methods of Analysis of the A.O.A.C., fourth edition, 1935, on page 277, under Fat, Roese-Gottlieb Method — Official. The word "milk" as used means cows' milk.

Evaporated milk.—A liquid food made by evaporating sweet milk to such a point that it contains not less than 7.9% of milk fat and not less than 25.9% of total milk solids. Optional ingredients may include (1) disodium phosphate or sodium citrate or both, or calcium chloride, added in a total quantity of not more than 0.1% by weight of the finished evaporated milk, (2) Vitamin D in such quantity as increases the total vitamin D content to not less than 7.5 U.S.P. units per avoirdupois ounce of finished evaporated milk. It may be homogenized, and is sealed to the container and so processed by heat as to prevent spoilage.

If vitamin D is added, this fact must be stated on the label immediately and conspicuously preceding or following the name "Evaporated Milk" without intervening written, printed, or graphic matter.

The vitamin D may be added either by irradiation, or by addition of a concentrate of vitamin D which may also contain vitamin A if the concentrate is obtained from natural sources) dissolved in a food oil. If this oil is not milk fat, it must not exceed 0.01% of the weight of the finished evaporated milk. The quantity of vitamin D is determined by the method prescribed in the Second Supplement of the 11th revision of the U. S. Pharmacopoeia, pages 132-134 and pages 136-138, with such modification of the method of feeding as is necessary for evaporated milk instead of an oil.

Concentrated milk or plain condensed milk conforms to the same standards as evaporated milk, except that it is not processed by heat, its container may be unsealed, and optional ingredients are not used.

Sweetened condensed milk.—The liquid or semi-liquid food made by evaporating a mixture of sweet milk and refined sugar (sucrose) or any combination of sucrose and refined corn sugar (dextrose) to such a point that the finished sweetened condensed milk contains not less than 28.0% of total milk solids, and not less than 8.5% of milk fat. The quantity of sugar used is sufficient to prevent spoiling. The cows' milk used may be adjusted by the addition or abstraction of cream or sweet skim milk or the addition of concentrated sweet skim milk.

* * * *

Award for Milk Studies

Dr. Henry Clapp Sherman, professor of chemistry at Columbia University and internationally known for his research in nutrition, received the 1940 Borden award for outstanding research. Outstanding contributions of Doctor Sherman which brought him the Borden recognition were his proof that a quart of milk in the diet produces animals superior to those receiving a pint of milk; that the vitamin A content is responsible for the good effects as well as calcium; that calcium is of superior availability to children in milk than in vegetables; and with increased intake of milk up to one quart daily the retention of calcium increases.

Doctor Sherman has demonstrated in many ways the wisdom of spending one-fifth or more of the food money on milk.

Presentation of the award, consisting of a gold medal and a check for $1,000, was made by W. A. Wentworth of the Borden Company, at the annual convention of the American Home Economics Association in Cleveland.

Predisposition to White Scour Due to Vitamin A Deficiency

It has been recognized for a considerable time that the chance of survival of the offspring is largely influenced by the ration of the dam during gestation.

Doyle has shown that mortality of young pigs ranging up to 100% may result from inadequate protein in the ration of the sow.

Patton has shown that experimentally 100% mortality in puppies results inevitably from planned deficiency in the ration of the bitch during gestation and before; even on a ration that will maintain weight and a fair condition of well-being.

Williams has pointed out that the incidence and destructiveness of uterine infection is in large measure governed by feed and management.

Stewart and McCallum in a recent report[1] of unusual importance record their findings in an investigation of the incidence of white scour and allied infections in a number of herds in Scotland. They state that the loss of calves in the first 10 days of life from white scour, joint-ill and navel-ill is very high. They believe there is a close relationship between these ailments and that the chief infecting agent is various strains of *B. coli.*

Smith and Little some years ago showed that the colostrum of the mother played an important role in the prevention of white scour and allied infections in calves, the death rate in colostrum-fed calves being very much lower than in calves not receiving colostrum. They postulated that a sufficiency of the mother's antibodies passed to the calf via the colostrum and helped it in the first days of life to combat infection until the protective mechanism of the calf began to operate.

Recently various research workers have shown that colostrum normally possesses a very large amount of vitamin A, and some have thought that this may be the substance which protects the young animal from the *B. coli* infections responsible for white scour, joint-ill and navel-ill. It is well-known that the amount of vitamin A in milk bears a close relation to its abundance in the ration, and that in cows vitamin A is stored (in the liver) principally during the non-lactating

period between calvings. As this varies in length and as the ration available to different animals during this period varies in richness in this vitamin, it seems reasonable to suppose that the colostrum varies widely in vitamin A content; and Stewart and McCallum found this to be the case. In something more than 200 samples of colostrum they found the vitamin A content varying from 59 to 2,590 blue units per 100cc.

Selecting 250 units of vitamin A as a dividing line and comparing the mortality of calves receiving colostrum containing more than this amount of the vitamin with the mortality of those receiving colostrum containing less than this amount, Stewart and McCallum adduced information lending strong support to the theory that the vitamin A content of colostrum is an important factor in protecting young calves from white scour and allied infections. In 150 calves receiving colostrum containing more than 250 units of vitamin A the loss from these ailments was 8%; in 56 calves receiving less than 250 units the loss was 23.2%. These calves were distributed in 14 herds in which the death rate from white scour had been high for a number of years.

Thus is scientific support adduced for the dictum of experience that the milk cow should have a "dry" period of several weeks immediately preceding calving.

[1] Stewart, James, and Jennie W. McCallum, 1938. "White scour" in calves and related infections. I. The significance of the vitamin A content of the colostrum as a predisposing factor in the causation of such conditions. *Jnl. of Comp. Path. & Ther.* 51:4, pp. 290-295.

Tularemia

From the increasing number of human cases and deaths from tularemia (rabbit fever) occurring each year it is apparent that many who hunt, handle, or consume the flesh of wild rabbits are unaware of the danger to man which may lurk in the small body of this animal. It would be well for the public to note that in 1938 there were in this country 2,088 cases with 139 deaths from this disease. The majority of persons contracting the disease had skinned or otherwise handled wild rabbits. During 1939, 2,200 cases were reported, and it is likely that the complete returns will show that approximately 150 deaths occurred among those cases.

Historically, tularemia is of great interest to us because our knowledge of the disease is almost wholly the product of American scientific research. The condition, later to be known as tularemia, was first described in 1910 by Dr. George W. McCoy of the Public Health Service in reporting a "plaguelike" outbreak among ground squirrels in Tulare County, Calif. McCoy and Chapin discovered and described the causative organism in 1912, calling it *Bacterium tularense* after Tulare County, where the disease was first observed. In 1919, Dr. Edward Francis of the Public Health Service, while studying "deer fly fever" in Utah, recognized its identity with McCoy's "plaguelike" disease of rodents and named the infection "tularemia."

Subsequent research has disclosed the presence of human cases of the disease in 48 States and the District of Columbia and has traced the source of human cases to 24 forms of American wildlife. Since 1925 tularemia has been recognized for the first time in 10 foreign countries.

Wildlife Sources of Tularemia

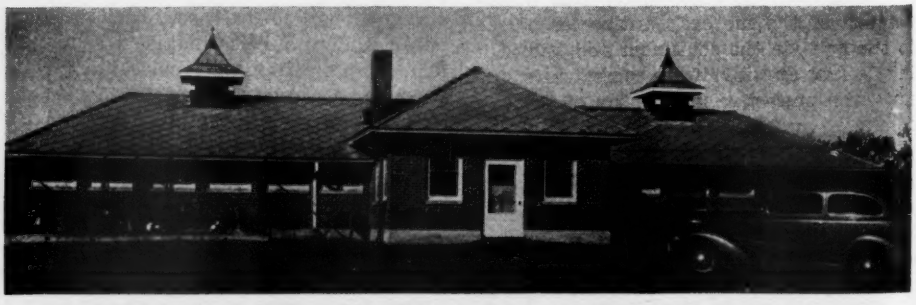
Wild rabbits and hares are the direct cause of over 90% of human cases in the United States. Rabbits raised under domestic conditions, although highly susceptible, have not been found naturally infected, prabably owing to their freedom from ticks. Market men, hunters, housewives, and others who dress rabbits with bare hands may becomes affected.

Horseflies have caused 68 cases, wood ticks 53 cases, the dog tick 73 cases, and sheep contact 12 cases.

Tree squirrels had been dressed by 14 patients. Nine had killed and skinned opossums. One case each followed the skinning or dressing of a sage hen, coyote, deer, red fox, or bull snake. Two cases each followed like contact with quail, ground hog, muskrat, hog, or skunk. Two had been scratched by cats and 11 were bitten by cats. Single cases have resulted from bites of raccoon, skunk, coyote, tree squirrel, Montana ground squirrel, opossum, dog, hog, lamb, and a white rat. The dissection of infected laboratory animals has caused 56 cases in laboratory workers.

Eating insufficiently cooked wild-rabbit meat caused 20 cases in five families in the United States, of whom 12 died.

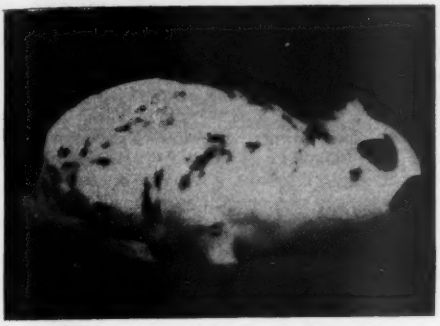
The disease of wild rabbits causes the liver and spleen to become covered with



KENNEL BUILDING AT THE INSTITUTE FOR MEDICAL RESEARCH, MAYO FOUNDATION

This building is equipped with built-in kennels, a food laboratory, heating plant, and a mechanical ventilating system. When the photograph was taken a portion of the building was being used to house turkeys. The car shown belongs to Dr. C. S. Schlotthauer

small spots which may be seen when the carcass is being dressed. The germs invade and multiply in every tissue in the animal's body, including blood and muscles, ultimately causing its death. Ordinarily, only about one in every 100 rabbits in the wild



An English Spot. The wild rabbit is the commonest source of tularemia in man

state is infected, but occasionally the disease becomes epizootic among them and then it is not uncommon to find dead rabbits lying about in their natural habitats.

On an average of about 3½ days after exposure illness begins in man suddenly with headache, chilliness, vomiting, fever, prostration, and aching pains all over the body. The symptoms are often mistaken for those of influenza. The sore, usually on the hand, develops into an ulcer, and the nearby lymph glands, at the elbow or in the armpit, become enlarged, tender, and painful, and later may develop into abscesses. Illness and fever last for about three weeks. Convalescence is slow and is characterized by great weakness and disability which may continue for two or three months. About 5% die.

Prevention of Infection

Hunters, vacationists, butchers, housewives, and laboratory workers who handle rabbits and other wild game are especially exposed to tularemia.

A wild rabbit should never be handled with the bare hands. Rubber gloves, so long as they are impervious, afford excellent protection, but they are easily pierced by the skinning knife or by fragments of bone.

Immune persons only should be employed in laboratories working with known or presumably infected animal and insect hosts of the disease. — *Excerpt from Public Health Report* 55:16.

Mistaken Diagnoses

Albert S. Arkush, M.D., and Alfred A. Kosky, M.D., as a result of a study at the Santa Monica (Calif.) Hospital, reach[1] the following among other conclusions with respect to cases diagnosed clinically as appendicitis:

Only two appendices out of three will confirm a clinical diagnosis of acute appendicitis.

The chances are one out of four that a diagnosis of chronic appendicitis will be verified by the pathologist.

When chronic appendicitis actually exists, the chances are about five in 12 that we will recognize it clinically; i.e., the chances are that we will not recognize it.

Thirty-five per cent of all individuals operated upon for diseased appendix have a normal appendix.

When we think that an appendix is chronically inflamed at operation, we are correct in about one case in four.

Whether the clinical diagnosis is "normal" or "chronic," the chances of the appendix being normal are almost the same.

The chief cause of error in the clinical diagnosis of acute appendicitis is some gynecologic condition. Next in importance come "no surgical lesion," gall bladder disease, and inflammation in the region of the cecum, in that order.

Where chronic appendicitis is diagnosed alone clinically and not found, the great majority of cases will reveal no lesion.

The mortality in acute ruptured appendicitis over a ten-year period was one in seven, and that of the nonruptured acute cases was one in 67.

When we diagnose chronic appendicitis and it is absent at the operating table, we are likely to find some other lesion in only one case in four if we did not expect it before operation, and in five cases out of six if we did expect it.

Of those operations for chronic appendicitis alone, over half reveal no pathologic condition whatever.

Of cases thought clinically to have acute or subacute appendicitis, one case in six revealed no pathologic condition of any kind at operation.

[1] *Journal of Laboratory and Clinical Medicine* 25:12, pp. 286-7.

The Newspapers Say—

New Cause and Cure of Hem. Sep. Discovered by Co. Agt.?

There is a serious condition among many herds of cattle in Wheeler County (Tex.), according to County Agricultural Agent Jake Tarter, who states that it is being caused by mineral deficiency. Most of the illness has been on farms and pastures of sandier soil. The mineral deficiency weakens the physical condition of the cattle to the extent that hemorrhagic septicemia gains headway and finally kills the animals.

Tarter says that a mineral mixture which will correct the trouble is two pounds of bone meal, two pounds of limestone and four pounds of salt. Cattle that already have the disease may be given a stimulant of one ounce of jamaica ginger in one pint of water. This stimulant may be given every 12 hours Tarter says.—*Wheeler* (Tex.) *Times.*

* * * *

Whadda You Mean, Humanely?

Because rabies among dogs in St. Louis County, Missouri, has been troubling the civil authorities for months, Police Chief McConnel of Webster Grove, a suburb of St. Louis, publishes a long notice in the *Times* instructing citizens to bring their dogs to the police station at specified times for anti-rabies vaccination. They are warned that if they don't do this their dogs—

will be picked up and impounded at the Humane Society shelter, where they will be held for five days. If they are not redeemed within that time they will be placed in homes or otherwise humanely destroyed.

* * * *

Calves Helped by Acid Milk

Use of acidophilus milk as a treatment for scours in calves has become general since it was originated by the Oregon experiment station in 1935, and it has given better results than any other known treatment, according to Drs. J. N. Shaw and O. H. Muth of the Oregon State College department of veterinary medicine. These men discuss the use of acidophilus milk in a new circular of information (No. 216), just issued by the experiment station and available from the college or from county agents. [Why not from veterinarians also?]

Scours in calves continues to be perhaps the most important disease affecting these newborn animals.—*Portland* (Ore.) *Oregonian.*

Inexpert Veterinary Service

A. R. Stewart, Jr., investigator for the State Veterinary Medical Association of Texas, is in the city for the purpose of investigating veterinary service in this country and the sale of bogus and fake poultry remedies.

Stewart explained that a tour of the state recently disclosed the appalling fact that there are many unqualified men attempting to practice veterinary medicine and that there are numerous spurious medicine peddlers and bogus "poultry technicians' who are swindling the live stock owners out of thousands of dollars each year.

The survey reveals that many persons are also engaged in the manufacture and sale of nostrums recommended for the cure and prevention of all known poultry diseases and the increase of egg production. Most of these preparations are badly misbranded.

Many poultry medicines found on the market cost no more than 30c per gallon, yet they are priced at sums ranging as high as $10 per gallon.—*Victoria* (Tex.) *Advocate.*

* * * *

Border Cowmen Alarmed by Ticks

Southwest Texas cattlemen along the Rio Grande from Del Rio to Brownsville are viewing with alarm the appearance of the Australian ticks among the cattle herds of northern Mexico. The Australian tick is much more dreaded than the Texas fever tick. Deer and dogs are known to be carriers of the Texas fever tick, but the insect cannot complete its life cycle upon them, whereas the life cycle of the Australian tick can be completed upon these animals. It is almost certain that deer especially would aid in spreading the Australian tick in the pastures of this country should the pest gain a foothold north of the Rio Grande.—*Mason* (Tex.) *News.*

* * * *

County Agent a Bang's Disease Expert

Dairy cattle owners of Hutchinson County are invited to submit their animals to government testing for Bang's disease. County Agent Clyde L. Carruth said yesterday that he would be glad for anyone wishing to receive this free service for their cattle to get in touch with him at his courthouse office.

Carruth, who has studied Bang's diseases for five years, is cooperating with the Bureau of Animal Husbandry of the U. S. Department of Agriculture in offering the tests.—*Barger* (Tex.) *Herald.*

Federal Veterinarian to Test Cattle for Bang's Disease

Dr. R. V. Fox, Federal Veterinarian, will be in McDonald County for two weeks testing for Bang's disease, without cost to the farmer, according to Assistant Agent John W. McClure.—*Pineville* (Mo.) *Herald.*

Business of Having One's Cake and Eating It

W. Z. Burke, veterinary with the Bureau of Animal Husbandry, will be in Eldorado the last week of May to give test to milk cows for T. B., according to County Agent W. G. Godwin.

Mr. Burke will give the test on May 27-28-29 and read the tests on May 30-31 and June 1. There will be no charge for this service.

Anyone in town or on farms that would like to have cows tested should notify the County Agent's office.—*Eldorado* (Tex.) *Success.*

Dean Marstellar often deplores the fact that large areas of Texas are without adequate veterinary service. The foregoing is offered as one of the reasons. Texas, where tuberculin testing, Bang's disease testing, rabies vaccination, and on occasion hog cholera vaccination are performed by public employees without charge to the owners of the animals; where a complete veterinary service is freely tendered the poultry industry from the same source; and where ranchers do their own blackleg vaccinating, would like a large additional number of highly-trained veterinarians for obstetric work and the treatment of colic in mules.

Anyway, It's Rather Serious

Provisional reports from the state hygienic laboratory at Iowa City reveal that 16 animals have been shown to have had rabies since the first of the year compared with nine positive reports for the corresponding period in 1939. All told in 1939, 31 positive diagnoses were made.

Rabies in man is rare but almost fatal, the department said.—*Edgewood* (Ia.) *News*

Something May Have to Be Done Eventually in Maysville

Rabies have caused the death of eight dogs during the past month, Dr. C. W. Christine, director of the health department, announced yesterday. Because of the widespread contact, Dr. Christine said that it may be necessary to institute quarantine for dogs over a localized area if the appearance of rabies continue.—*Maysville* (Ky.) *Independent*

Bang's Disease Prevalence

Extension bulletin 209, issued by the Minnesota agricultural extension service, stresses that Bang's disease exists in nearly all countries where cattle are raised. In Minnesota, the testing campaign so far conducted has shown one herd out of every three to be infected by the disease, resulting in an annual loss exceeding $500,000.—*Sioux City* (Ia.) *Journal*

The Lexicographer's Easy Chair

The ambulatory clinic is a system of professional education by motion pictures. Clinical pictures of operations on animals and other interesting features were illustrated on the screen as Dr. Beck described the ways in which such pictures are sometimes superior to actual demonstrations in making points clear to the student.—*Atlantic City* (N. J.) *Union*

Where Rabies Quarantines Have Become the Normal Condition

Two more rabid dogs that bit three more persons were reported to the city health department today, following reissuance of an order requiring muzzling of dogs in Minneapolis for another four months. A total of 28 rabid dogs has been reported in the city since Jan. 30, including six in June.—*Minneapolis Journal*

Particularly All Males

Dr. Verne C. Bartlett, of the United States Department of Animal Industry, who has been stationed at Poplar Bluff, the past two years, has been transferred to this territory to spend a year on Bang's control work in Putnam, Scotland, Knox, Schuyler, Sullivan and Adair counties. Dr. Bartlett's headquarters will be in Kirksville.

In Southeast Missouri, he said, the disease had gained such headway tests revealed necessity for disposal of every animal in several herds. Of 305 cattle tested on one project, Dr. Bartlett said 152 showed infection.

Persons desiring to have their herds tested should make their applications through county agent Neff's office.

There will be no charge for this service and he is anxious to test every cow and male in the county during the year. One diseased cow or male left on a farm will reinfect the entire community, he said.

The veterinarian said the only effective control is disposal of infected animals. Most states have laws requiring herd owners to submit their animals both cows and males to Bang's disease tests, he added, and lack of such a statute in Missouri seriously hampers its eradication. — *Kirksville* (Mo.) *Express-News*

Army Food Inspection in the World War

During the World War there was one department of the veterinary service of the army whose work was satisfactory to everyone—about which no complaint was made either in or out of the army—where the morale was high and the discontent nil; we refer to the meat and dairy products inspection service. The same accolade may be given the veterinary laboratory service as carried out in the United States, but it achieved far less public and military acclaim.

The army meat and dairy products inspection service of 1917-19 had many obstacles to overcome—it had to undergo a tremendous expansion under pressure of constantly increasing purchases; there was little time for planning; few trained men were available, and a school for inspectors had to be started and instruction carried on conjointly with ever increasing extension of the work. Notwithstanding these handicaps the service accepted full responsibility for the quality and condition of meat and dairy food products supplied the Army and discharged it with a degree of skill and fidelity that afforded complete protection to the health of the troops and without so much as a whisper of scandal from anyone, although a repetition of the meat scandals of Spanish-American War times was rather expected by the public as being inevitable.

Credit for the splendid achievement of the meat inspection service is due chiefly to the late Major George A. Lytle. Almost without regulations or direction from superior authority he was able to see the problem that was his to solve, to plan the solution and execute the plan without confusion or seeming haste. Could he have organized the whole veterinary service had the Surgeon General ordered him into his office at the beginning of the war? Probably not. Meat inspection had been Major Lytle's work for years. Had his experience been with troops, we see no reason to doubt that he could have organized the veterinary service with animals as efficiently as he did the food inspection. Major Lytle was that kind of officer.

An idea of the immensity of the task that confronted the meat inspection service may be gained from the following figures showing the monthly increase in the value of meat products purchased at Chicago. In April, 1917, it was $304,000; in May, four times as much, $1,275,000; in June, nearly $3,000,000; by August it was more than $5,000,000, worth more than sixteen times the amount in April. By October purchase had increased to $8,500,000, and not one dollar of this purchase money then or later was paid but upon the certification of a veterinary officer.

Practically all the inspectors had to be trained for their work. In May, 1917, authority to establish a school for meat inspectors at Chicago was requested of the Surgeon General. In June the first group of 30 officers arrived for instruction. Traveling inspectors were soon required to standardize the work at camps and cantonments; install a comprehensive system of reports, and establish the work on a uniform basis. This required practically all the trained personnel in the inspection service at Chicago, and in the face of rapidly mounting purchases a new inspection force had to be built up. Almost as soon as that was achieved came a call for inspectors for a chain of freezers that had been established, stretching from New York City to Ogden, Utah. New York City alone had a freezer capacity of 100,000,000 pounds. There were 49 freezers into which fresh beef was shipped to be frozen and sent out to the seaboard as needed; each required one or more inspectors.

The duties of the veterinary personnel in the army meat inspection service are given as follows:

The Veterinary Corps personnel reported upon the sanitary condition of factories and freezers and selected practically every carcass of beef shipped to the United States Army abroad or used in the manufacture of canned corned and roast beef. After selection, the beef carcass was trimmed, quartered, weighed, sacked, marked, loaded properly and into cars which were clean and substantial and well iced under their supervision, and the car number and seals were reported to the veterinarian on duty at the freezer to which it was consigned. Upon arrival at the freezer the

veterinarian on duty there received the car from the carrier; if it could not be unloaded promptly he saw that it was kept iced. When unloaded he examined the contents, saw that the beef was spread to insure rapid and uniform freezing, kept track of the lots, removed the covering from a few quarters to satisfy himself as to its condition, and reported faulty trimming or inferior quality. He inspected outgoing shipments to see that the products were properly frozen, that the cars into which they were loaded were clean and properly cooled, that quantity and weight loaded were correct, and inserted the necessary figures on billing furnished him. The veterinarians saw meat for canned products boned, trimmed, cured, cooked and canned in a sanitary and proper manner, watched the closure of the cans and the lacquering of them, saw them tested for defective cans before being boxed, examined the boxes, supervised the marking and strapping, counted the cases into the cars, and furnished seals and car number, together with other data for the accomplishment of the bills of lading, and in more than half of the cases accomplished the billing themselves. With the bacon they watched the selection, trimming, piling, curing, overhauling, brushing, smoking, wrapping, boxing or canning, weighing, marking and shipping. Hams were all selected, tried, smoked, wrapped, weighed, boxed, marked and shipped by this corps.

Reports were made each morning showing the various operations carried out on the preceding day, the amounts of beef accepted and shipped, the quantities of bacon placed in cure, smoked or canned, the number of cans filled, amounts of beef received at or shipped out of freezers. All movements of fresh beef were reported by the veterinary officers by wire at the close of each day's business. These data were used by the Purchasing Officer in his work of procurement.

The manufacture of oleomargarine and butter was carefully watched, windows screened, ample drainage required and the necessary sanitary precautions taken. The experiences with centralized butter and its manufacture prompts the statement "Supervision of these plants is badly needed" and was responsible for the recommendation that no centralized butter be purchased by the Army unless manufactured under strict sanitary conditions.

As an illustration of the many things it was necessary for the inspector to keep in mind, the following sample of the specifications for fresh beef is quoted:

1. Beef, fresh: To be good in quality and condition, fit for immediate use, and equal numbers of fore and hind quarters to be delivered, including all the best cuts; hanging tenderloin and kidney fat removed; no carcass to weigh less than 450 pounds when trimmed;

This account of veterinary service in the army during the World War, like the one published in the September issue of *Veterinary Medicine* (pages 486 to 490), is taken from *Veterinary Military History of the United States*. In the former the difficulty and delay that arose in organizing a veterinary service for army animals, and the imperfections of the service when finally it was organized, were told. This account, unlike the former article, deals with a branch of the military veterinary service that was organized promptly upon the outbreak of hostilities and operated efficiently. The army food inspectors did a supremely good job during the World War, not only for the army but for the future of the veterinary service of the army. During the past 18 years while the number of animals belonging to the army was reduced 50%, the personnel of the Army Veterinary Corps suffered no reduction, solely because of the need for it in food inspection. During the past three years the number of veterinary officers in the army has been more than doubled by assignment of reserve officers to active duty in the CCC and the expanded air service. In both, the duties of these veterinary reserve officers are exclusively those of food inspection. Recent Congressional action provides for inducting nearly a million additional men into the military service and the purchase of 20,000 horses by the army has already been authorized. The call upon the Veterinary Reserve will undoubtedly be heavy in the next few months. Veterinarians entering the army from the Reserve will be less at sea and will make better officers if they know the background of the military service in this country.

necks to be cut off perpendicularly to the line of the vertebrae, leaving but three cervical vertebrae on the carcass; the shanks of fore quarters to be cut off two inches above knee joint and of hind quarters at the hock joint (commercial cut), and to compensate for the shank bone thus allowed to remain 3½ pounds will be deducted from the weight of each hind quarter; difference in weight between fore and hind quarters not to exceed 25 pounds per carcass (one rib to be left on each hind quarter). Neck, kidney fat, beef from bulls and stags and from females (except from spayed heifers) will be excluded from delivery.

Student officers as they graduated from the meat inspectors' school were assigned largely to camps as division meat inspectors for those organizations.

In February, 1918, the inspection of butter was taken over by the veterinary service. This work increased, as had the inspection of meat. In September, 1918, alone the veterinary service graded, weighed and certified for payment butter having a total value of $2,881,226, and more than 3,000,000 pounds of cheese. In this same month, the purchases of meat exceeded 34 million dollars in value and in October (1918) meat purchases exceeded $50,000,000.

The work of the army food inspection was summarized by Major Lytle as follows:

The Veterinary Corps inspected at purchasing points from April, 1917, to March 31, 1919, the following products:

	Pounds
Beef, fresh, frozen	448,525,595
Beef, corned	199,611,056
Hash, corned beef	100,331,228
Roast beef, canned	128,115,860
Mutton, fresh	214,700
Pork, fresh	12,524,635
Bacon	296,864,734
Ham	19,007,921
Deviled ham	26,421
Salt pork	4,000
Pork sausage	4,942,504
Lard	2,196,628
Lard compound	45,000
Lard substitute	8,370,038
Sausage, Vienna style	6,144,405
Oleomargarine	15,382,302
Cheese	8,811,026
Butter	8,522,689
Turkey	2,137,699

This represents a total of 1,261,778,441 pounds, having a money value of $473,914,827.62, not to mention 234,153,619 pounds inspected at camp, 31,454,566 pounds of meat inspected, packed and shipped for civilian relief work in Europe, and almost a million pounds of beef, fresh, frozen, inspected for the Italian Government. In all, 10,956,408 pounds were rejected, making a grand total of more than one and one-half billion pounds.

From April, 1917, to November, 1918, the meat-inspection force at procurement points had increased in personnel to 78 officers and 109 enlisted men, located in 102 meat-producing establishments, in 31 cities, who had been on duty at one time or another during that period at 47 procurement points. In the school 82 officers and 96 enlisted men had been trained and recommended for assignment to camps and 116 applicants examined for commissions in the Veterinary Reserve Corp.

These products cost the government nearly seven times as much as all the horses it purchased in this country. When in 1918 the army reached 4,000,000 men the *daily* allowance for meat required more than 10,000 cattle and 22,000 hogs.

The history of the Chicago depot during the war contains this statement:

The work performed by this force [meat inspection] was of the highest order, and a glance at the procurement tables which follow will give a general idea of the amount of work performed by this important unit. That the articles furnished were properly prepared and rigidity of inspection maintained during the course of manufacture is evidenced by the fact that less than one-half of one per cent of the total quantity was lost by deterioration.

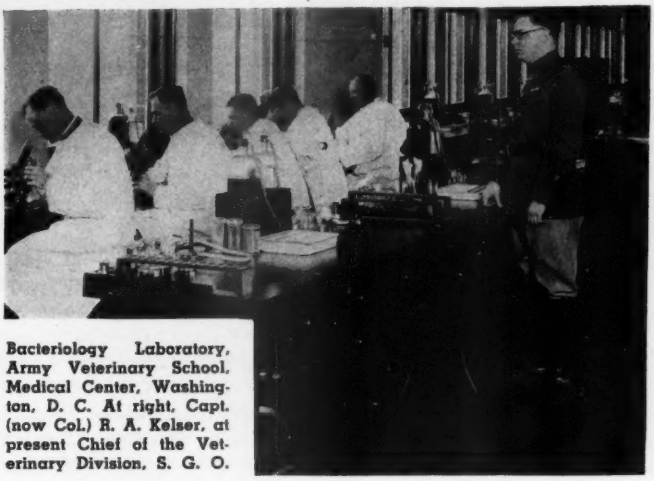
Brigadier General A. D. Kniskern, in charge of the Packing House Products Branch of the Quartermaster Department, said of the veterinary meat inspection service:

Such comprehensive knowledge, judgment and care was used in training and directing the rapidly increasing force of meat inspectors and in the conduct of these inspections that hundreds of millions of pounds of meats were passed by them as complying with Army specifications and there was no complaint as to quality and condition.

A military service publication in a long article dealing with the veterinary service of the army said of the meat inspection service:

The packing house products branch of the office of director of purchase and storage, which is charged with furnishing the army with meats and meat products, was purchasing, just prior to the Armistice, an average of 15 to 19 million pounds of meat products weekly. These products consisted of beef, bacon, hams, canned meats, oleomargarine, butter, cheese, lards, lard substitutes and other products. Every pound of meat shipped to

France for our troops was inspected by veterinary officers. Knowing the duties of the veterinary corps, these figures can give some idea of the importance of this service at the present time, when one is almost led to believe that this war was one of science and modern mechanics alone.



Bacteriology Laboratory, Army Veterinary School, Medical Center, Washington, D. C. At right, Capt. (now Col.) R. A. Kelser, at present Chief of the Veterinary Division, S. G. O.

The Army Veterinary School was established at Chicago soon after the World War and moved to the Army Medical Center (then Walter Reed General Hospital) in 1923. All veterinary officers entering the Regular Army are assigned to this school for a six-month graduate course in military veterinary medicine

From no source was any criticism of the food inspection heard. At the close of the war the veterinary service owed much of its reputation for usefulness among War Department officials, and hence its chance of perpetuation, to this branch of its work. In 1918 it was said of it:

The meat inspection service of the veterinary corps has expanded with the growth of the army since the outbreak of the war. All meats and meat products purchased by the depot quartermaster in Chicago and the subsidiary depots in other large cities are carefully inspected for compliance with specifications. This covers practically all the refrigerated beef, canned meats, ham and bacon that are sent to the oversea forces or issued to troops in this country. Veterinary meat inspectors remain in the packing houses and observe the process from the selection of the meat to the sealing of the cans in which it is packed. Every step in the process receives a critical scrutiny in order that the Government may secure only meat from sound animals which has been properly prepared and preserved for transportation.

The service in Chicago is supervised by Major George A. Lytle, V.C.N.A., assisted by 43 veterinary officers who are trained meat inspectors and 25 enlisted men. Meat inspectors who have been properly trained under the regulations of the Bureau of Animal Industry are the only ones engaged in this work and some difficulty is encountered in securing enough men for the enlisted force in particular. These enlisted men are not veterinary graduates but must have had at least one year's experience with packing house methods. Men of this class who are subject to the selective draft or who wish to enlist should communicate with the Surgeon General.

A veterinary officer is attached to each division as meat inspector and each cantonment is allowed a division, or camp, meat inspector with two enlisted assistants. Officers and men selected for this work are sent to Chicago for the course of instruction before assignment to stations.

. . . . . .

Summarizing the service rendered by the Veterinary Corps, it seems appropriate to call attention to the fact that the commercial value of the property "inspected and passed" during the World War emergency, including food, horses and mules, exceeded half a billion dollars and that notwithstanding the rapid expansion of the service from practically nothing to a creditable organization, no complaint or charge of technical inefficiency can be uncovered either in gossip or on the record.

Small Doses of Phenothiazine Effective

Phenothiazine continues to attract the attention of parasitologists and practitioners. A number of English workers have recently carried out extensive research, coordinated through the Agricultural Research Council, on the efficacy and proper dosage of this remarkable anthelmintic, reporting their results in a symposium in the *Veterinary Record* for September 7th. They confirm the findings of the American and Australian workers as to the efficacy of phenothiazine against Strongylus, Trichostrongylus, Ostertagia, Haemonchus, Cooperia and Ascaris spp. in various species of animals.

Phenothiazine in Horses

The English workers (Taylor and Sanderson, using 52 horses; Grahame, Morgan and Sloane, using 95 horses; Knowles and Franklin, using three horses) found phenothiazine highly effective against strongyloid parasites in horses; in fact, in most instances 100% effective. They found a dose of 30 to 40gm (0.06 to 0.08gm per kilogram body weight) to be absolutely efficient in the removal of strongyloid parasites; doses of 10 to 20gm partially so. Showing the wide margin of safety of this product for horses, Lapage found a dose of approximately 17 times the therapeutic dose (500gm) to be well tolerated.

Cattle

Taylor and Sanderson found 25 to 40gm doses of phenothiazine effective against *Ostertagia ostertagi* in calves. A dose of 70gm in adult cattle was effective in reducing the egg count, but produced toxic effects. Although Lapage found that doses of 80 to 125gm were non-toxic to calves six months old, the observation of Taylor and Sanderson was that the tolerance of cattle for the drug is less than that of horses or sheep. However, the experiments (although carried out on too few animals to be conclusive) indicate that phenothiazine in carefully-regulated doses will be useful in controlling the stomach worms in cattle associated with parasitic gastritis.

Sheep and Goats

Observations involving some 300 to 400 sheep and 70 to 80 goats confirmed the findings of American workers[1, 2] that phenothiazine is remarkably effective against stomach worms and is superior to copper sulphate and nicotine sulphate in this respect. In the small intestine of these animals it is less efficient, but removes about 80% of the trichostrongylid parasites there, with the exception of Nematodirus, on which it exerts little action. There is no action against Fasciola nor against the anoplocephaline cestodes Moniezia and Anoplocephala. No findings with respect to hookworms or nodular worms were reported, al-

E. L. Taylor

Doctor Taylor is Senior Research Officer of the Department of Parasitology of the Ministry of Agriculture, Weybridge. Much of the English research on phenothiazine here reported was carried out by him or under his direction.

[1] Harwood, Paul D., Robert T. Habermann and A. C. Jerstad, 1939. Efficacy of commercial phenothiazine for the removal of roundworms from sheep. *Vet. Med.* 34:7, pp. 440-443.

[2] Habermann, Robert T., and Paul D. Harwood, 1940. Efficacy of recrystallized phenothiazine for the removal of nematodes from the gastrointestinal tract of sheep. *Vet. Med.* 35:1, pp. 24-29.

though American studies[1, 2] have shown high efficacy for these parasites.

A smaller dose (10gm) than that recommended by American workers was found to be adequate in sheep and goats, although doses of 20 to 30gm were more likely to produce the maximum effect. Doses as low as 5gm and even 2gm were usually remarkably effective but sometimes failed to remove the parasites, particularly those inhabiting the intestine. There were indications that in field use 5gm doses might be entirely satisfactory against stomach worms. The tolerance of these animals is very high, 400gm causing no ill effect. Repeated small doses, however, proved toxic.

Swine

Few experiments with swine have been undertaken by the English workers to date. Inconclusive experiments, however, indicate that (1) individual dosage is safer than mass dosage administered in the feed, toxic effects being observed in several pigs following administration of the drug by the latter method, presumably because of ingestion of larger quantities of the feed and hence of the drug; (2) young pigs appear more susceptible than older ones to toxic effects; (3) doses ranging from 0.1gm to 0.5gm per kilogram body weight have little effect in removing ascarids.

These indications, taken in connection with the results of Swanson, Harwood and Connelly,[3] would seem to point to the necessity of further experimentation with swine, with a view to determining the minimum toxic dose for these animals, and the efficacy of doses beneath this level for the removal of ascarids.

The English workers did not experiment with the removal of nodular worms from swine. (Swanson, Harwood and Connelly[3] have shown that a dose of at least 5gm is nearly 100% effective in removing nodular worms from adult swine.)

Other Findings

The English symposium contains the first report of the trial of phenothiazine as an anthelmintic in dogs. Montgomerie fed ascaris-infested puppies weighing nine to 13 pounds doses of the drug ranging from six to 12gm. Surprisingly (in view of the almost 100% efficacy of phenothiazine against ascarids in horses) there was little or no effect on the ascarid infestation in the puppies. All the puppies tolerated the drug well, with no symptoms of intoxication.

The English workers found that horses, pigs and sheep will consume phenothiazine when mixed with the feed, although, as noted in the case of pigs, this method of administration may be contraindicated for other reasons. In general, they preferred administration in liquid or tablet form where possible, to insure better control of the dose. Taylor and Sanderson prefer the table form for sheep, because of its greater safety. They administer the tablets by means of a rubber-ended balling gun, and report that they were able to give a dose of 10gm (two tablets) to each of 120 lambs in only 45 minutes, without undue haste.

Cattle can be treated easily by the administration of a liquid or of a draught made from tablets allowed to disintegrate in water.

The appearance of the red dye thionol in the urine for some three days after the administration of phenothiazine, which has been noted by American workers also, makes it advisable to warn the owner of the animal of this harmless effect, since otherwise it may be mistaken for blood. No suggestions have been made as to how to overcome the staining of the wool in sheep by the thionol, which is a very fast dye; this will undoubtedly be regarded as a distinct drawback by sheep farmers.

No mention of experimental work with chickens, which has been begun by American workers,[4] was made by the English group.

As a result of their studies, it is the opinion of Taylor and Sanderson that the greatest usefulness of phenothiazine will be in the treatment of strongylosis in horses and parasitic gastritis in sheep and cattle. In fact they postulate it may be found practical to eradicate strongylosis from the premises by the use of phenothiazine alone.

[3] Swanson, L. E., Paul D. Harwood, and James W. Connelly, 1940. Phenothiazine as an anthelmintic for the removal of intestinal worms from swine. *J. A. V. M. A.* 96:756, pp. 333-338.

[4] McCulloch, Ernest C. and Lyle G. Nicholson, 1940. Phenothiazine for the removal of Heterakis gallinae from chickens. *Vet. Med.* 35:7, pp. 398-400.

Animal Parasites and Parasitism

By GEORGE W. RAWSON, Detroit, Mich.

Nearly 2500 years ago, Socrates advised his pupils to define their terms before discussing a subject, in order to avoid confusion and misunderstanding. This advice is still sound. In a broad sense, an animal parasite is an organism which lives on or within the body of another. In a more restricted sense, it is one which not only lives at the expense of another, but also produces some obvious injury to its host.

There are many degrees of parasitism. For instance, there are numerous instances in which parasites live in or on their hosts with benefit to both. Biologists call this condition symbiosis or mutualism. A very good example is the relationship between a certain species of protozoa and the termite or white ant. These termites, which live on woody material, are unable to digest it without the aid of the protozoa living in the digestive tract of their host. In turn, the protozoa benefit by obtaining food and protection.

When a parasite lives on or in its host with no injury to the latter but with no particular benefit to it, the condition is called commensalism. An example is found in certain species of lice that live on the epithelial debris on the feathers of birds, apparently without causing any inconvenience or harm to their hosts.

In addition to symbiosis and commensalism, there are several other degrees of parasitism, each of which has been given a special designation, chiefly of interest only to the parasitologist. Perhaps it may be enough to say that parasitism may range all the way from mutual benefit to parasite and host, to a condition where the effects of the parasite are so harmful that its host is destroyed. This extreme form of parasitism cannot be regarded as "planned economy," because no far-seeing parasite would deliberately destroy its means of livelihood and thereby itself. The ideal of any ambitious parasite is to live and let live without causing too much damage. In this way it can find what most of us are looking for—a comfortable living with a minimum expenditure of energy. As a matter of fact, the survival value of almost any species of parasite largely depends on the relative welfare of its host. If a parasite quickly destroys its host, the chances for survival of the species is materially lessened. During the evolutionary development of parasites, they have learned to adapt themselves to their hosts fairly well. When an exception occurs it is chiefly due to some new or more or less irregular condition.

Parasitism Leads to Specialization

Living at the expense of others with very little exertion results in the atrophy, modification or loss of various organs that are not used. This may be regarded as an adaptation to a special mode of life resulting in specialization. Many species of parasites have become so dependent on their hosts that they cannot possibly live without them. This dependence has led to the development of most remarkable methods of finding suitable hosts. One of the common methods is by the production of enormous numbers of eggs. Some species are little more than egg-producing machines. High productivity is necessary for species survival, because a single egg has a very poor chance of reaching a suitable host; perhaps about as much chance as a lottery ticket holder has of winning a prize in the Irish Sweepstakes.

Ability to produce large quantities of eggs is by no means the only method that parasites employ to preserve their species.

Two other examples may be mentioned. Some species place their eggs in advantageous positions so that they will have a reasonably good chance of finding a suitable host. For instance, a certain species of gadfly, *Dermatobia hominis*, lays its eggs on mosquitoes. As soon as the egg-bearing mosquito finds a warm-blooded animal on which to feed, the warmth of the animal's body causes the eggs to hatch, and the young larvae attach themselves to the body of the new host. Here they bore through the skin and feed on the subcutaneous tissue until they are fully grown and ready to pupate. After this, they fall from the body of the host, burrow into the ground, and form a pupa from which they emerge as fully developed gadflies. Another example of selecting a suitable site is found in young seed ticks, which attach themselves to vegetation along the paths of warm-blooded animals. As soon as an intended victim brushes against the tick-infested vegetation, the young ticks precipitately crowd upon their host, like New Yorkers boarding a subway train during the evening stampede.

Among the most highly specialized animal parasites is the tapeworm. It has so degenerated, or to put it more politely, become so greatly modified by its parasitic habits, as to be nothing more than an organism devised for the special purposes of absorbing nourishment and producing eggs.

Origin and Evolution of Animal Parasites

While it is seldom possible to trace the various steps whereby parasitic species of animals developed their parasitic habits, it is assumed that the early prototypes were free-living ancestral forms. Most parasites belong to groups that are much more primitive than their hosts, which is evidence that their ancestors were probably free-living creatures long before their more highly-evolved hosts made their appearance on earth. Further evidence that parasites developed from non-parasitic ancestry is found in the fact that we find both parasites and free-living species in the same family and even in the same genus. Some biologists believe that symbiosis and commensalism may lead to parasitism; the majority, however, regard them as a result of parasitism, the parasite-host relationship becoming highly adapted. On the contrary, it seems quite possible that when two species live in close association, one may take advantage of the other, leading ultimately to fixed parasitism.

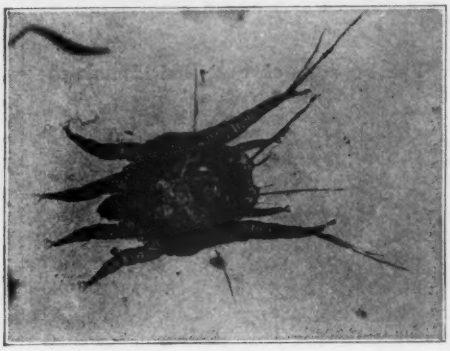
The Prevalence and Distribution of Parasites

Parasitic species are found in practically all the animal phyla. The only phylum in which no parasitic species are known is the one which comprises the starfishes, sea urchins, etc. (Echinodermata). A number of phyla have very few parasitic forms, while three have a relatively large number: the Protozoa, or one-celled animals, the Platyhelminthes, or flatworms, and the Arthropoda—the crayfishes, insects, spiders, centipedes, etc.

In the phylum Vertebrata there are many species which might be classed as parasites in a broad sense; or more accurately predators. Man is probably the most outstanding example. He not only destroys and feeds on a large number of species of lower animals, but shares with the shark and a few others the distinction of preying upon his own species. His parasitic habits may extend anywhere from the comparatively benign form of "panhandling" to murder, cannibalism, and warfare. The parasitic or predatory tendency of humans is so diversified and complex that it is practically beyond adequate description. Not a few persons are thoroughly convinced

Of the many internal parasites infesting the horse, perhaps the most common are the ascarids. This one was fourteen inches long, and came from a yearling colt following administration of a worm capsule

that all creatures on the earth were purposely created for man's edification, use and exploitation. We revile the lowly bedbug; but it rarely kills, whereas man de-

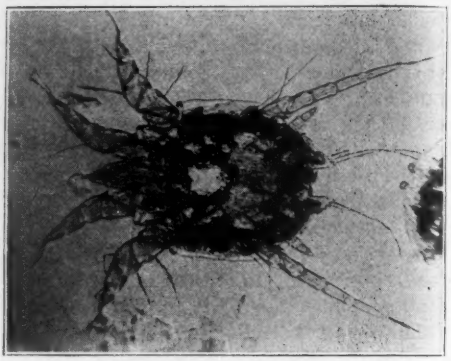


Otodectes cyanotes var. Cuniculus—Wenger

stroys millions of animals annually for food. Another unique distinction of man is that, with the exception of the weasel and possibly a few other animals, he alone habitually kills for pleasure—"sport." Lower animals usually kill only to defend themselves, to protect their young, or for food.

Some species of animals are more heavily parasitized than others. This is usually due to environmental factors more than to species susceptibility. Of the domestic animals, the horse is supposed to have more parasites than any other, sheep probably coming in a close second. While man is susceptible to a large number of parasites (many of which can be transmitted to him from the lower animals), he has relatively few. This is chiefly due to his more sanitary habits; he usually does not eat off the ground, and he is commonly protected by the proper disposal of waste material, a supply of clean drinking water, the inspection of food and a better knowledge of how to avoid parasites. In short, he does not defecate upon his own dinner table as the herbivora habitually do. Once the barriers of sanitation are removed, man falls an easy prey to parasites as well as to bacteria and pathogenic fungi, as may be witnessed during times of general disaster—floods, earthquakes, or wars.

Domestic animals are usually much more heavily parasitized than feral. Under domestication, improved conditions are provided for contact and the rapid multiplication and spread of parasites. In the natural state, wild animals rarely congregate in large flocks; when they do, they do not usually remain in one place very long for the reason that the food supply is soon exhausted. Because of the nomadic habits



Otodectes cyanotes var. Felis—Wenger

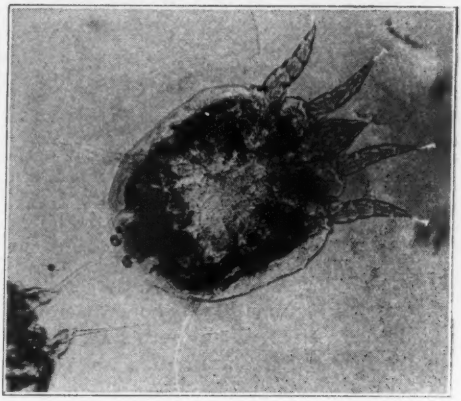
of wild animals and the relatively large area over which they roam, parasites do not get the same chance to come in contact with them or to spread from one animal to another with such facility as they do in domestic species. Domestic animals are confined as a rule in relatively small pens or pastures, which are usually occupied year after year. Under such conditions parasites have an excellent opportunity to develop and to spread. This is particularly true of intestinal parasites, because their eggs are passed onto the ground with the feces of their host. In a very short time, millions of eggs contaminate the soil, and animals confined to such areas are constantly reinfested by ingesting the parasites' eggs with contaminated herbage or drinking water, or merely by licking eggs off their hair or fur. External parasites have an equal opportunity to spread because under domestication animals come in close contact, making it an easy matter for a parasite to transfer itself from one host to another.

Another factor which has helped to spread parasites in domestic animals is our modern facilities for transportation. New

species are introduced by the shipment of infected live stock, sometimes thousands of miles away from their original habitat. In the days of slower and more difficult transportation, live stock were not as a rule moved very far, and consequently parasites were limited in the speed and extent of their spread. Introducing new species of parasites into new territory or into live stock unaccustomed to them may prove to be disastrous, for several reasons. In the first place, the new host may not have developed any resistance or immunity to the parasites, so that it may be seriously affected. This is very well illustrated by the introduction of northern cattle into territory occupied by the Texas fever tick. Native cattle develop relative immunity against Texas fever by being exposed to infection at an early age, whereas northern cattle have little or no immunity because they are raised in territory free of the Texas fever tick and therefore do not have a chance to build up any resistance. Secondly, animals entering new territory may be free from natural enemies which in their native habitat help to keep down their numbers. A classical case is exemplified by the rapid multiplication and spread of the European rabbit soon after it was introduced into Australia, due to the almost total absence of native mammalian predators.

The Loss Caused by Parasites

So far as man is concerned, the damage caused by animal parasites may be roughly divided into two classes; i.e., physical damage caused to himself and his live stock, and financial loss. Unless we can quote the amount of damage caused by parasites in dollars and cents, the average business man is unimpressed. Unfortunately, it is very difficult to give a statistical estimate of the amount of damage produced as a result of parasites. Quite frequently losses are too intangible to quote in definite figures. Anyway, for the benefit of our business friends, one or two isolated examples of financial losses resulting from parasites can be given. For instance, the ox warble fly, the grub of which makes holes in the hides of cattle, is estimated to cause a total loss of $50,000,000 a year in the United States, and from $7,000,000 to $14,000,000 in Canada. This loss includes the reduction in the value of hides, loss in the production of milk and meat, and



Otodectes cyanotes var. Canis—Wenger

loss of animals (many cattle are killed by falling over cliffs, or otherwise damaged in their attempts to escape from ovipositing female flies). According to the late Dr. M. C. Hall, Chief of the Zoological Division of the National Institute of Health at Washington, D. C., Texas fever plundered the cattle industry of the United States of $73,000,000 annually for many years. During a single month, the liver fluke, which damages the liver of sheep, caused the condemnation of 100,000 livers valued at $150,000.

If the actual loss resulting from animal parasites could be quoted in figures, it would no doubt represent a staggering sum that might, in comparison, make the national debt seem small, even to a Republican.

While there are a number of species of animal parasites that cause considerable damage and ill health to their host, most species cause little if any appreciable damage, because the parasite and the host have been able to adjust themselves to each other. This host-parasite relationship is a well-recognized phenomenon. When damage is produced in a host animal, it is usually of a slow and insidious nature, and symptoms may not be noticed for some time. One of the disadvantages of chronic

parasitism, particularly the kind resulting from worm infestation, is that the effects of general unthriftiness, loss of weight, weakness, etc., may be wrongly attributed to some other disease. In this way the harmful results continue because of the

Chicken fluke *(Psilostomum ondatrae)* X 22

failure of owners to recognize the true nature of their animals' affection. When epidemic diseases break out, either in man or in his domestic animals, they are usually of such a spectacular nature that immediate steps are taken to control them. This is not always the case with most parasitisms because the damage they do may pass unrecognized until considerable loss has been sustained.

Parasites Responsible for the Control of Other Forms of Life

Parasites are not all harmful. As a matter of fact, if it were not for a large number of species of parasitic wasps and flies, we might have a pretty miserable time on earth, possibly could not exist at all. The effectiveness of predatory species in keeping harmful insects and other forms of animal life under control has been turned to advantage by biologists, who now raise millions of certain species of parasitic wasps, flies and beetles for liberation in orchards, farm lands and other areas to help control destructive insects, such as the corn borer, the Japanese beetle, San Jose scale insect, gypsy moth, and bollweevil. In a state of nature, predatory parasites do fairly well in keeping insects under control until man interferes with the normal balancing by throwing a figurative monkey-wrench into the machinery. An excellent example of man's unconscious bungling is shown by the introduction of the European gypsy moth, which has caused the New England states millions of dollars in destruction of trees and in attempted control measures. In Europe the gypsy moth causes comparatively little damage, because it is kept under control by its parasites. Unfortunately, when the gypsy moth was introduced into the United States, its enemies did not accompany it, so that it had full opportunity to multiply and spread with very little hindrance. Several years ago an African mosquito (*Anopheles gambiae*) was inadvertently introduced into Brazil, probably by airplane. From its starting point at Natal in eastern Brazil, it has advanced at the rate of approximately nine miles a year, so that it now occupies about 12,000 square miles of territory. This insect is a vector of a virulent form of malaria. During a single month (in 1939), 114,000 persons were treated in Brazil for this disease. If the airplane was responsible for the introduction of this mosquito, it shows that this device can be just as destructive in spreading death in this manner as when it is used for dropping bombs.

Parasites also play a part in controlling the relative abundance of wild game. In fact, some authorities believe they play a major rôle in keeping a number of species in normal balance, or in some cases, in reducing their numbers below normal. An excellent example is the effect of tularemia on the cotton-tail rabbit, jackrabbit and snowshoe hare population, spread from rabbit to rabbit principally by the rabbit tick, *Haemaphysalis leporis-palustris*, but also by other blood-sucking arthropods such as flies, lice and fleas.

Two species of parasitic flies which affect the destinies of mankind probably more than any others are the tsetse flies of Africa and the various species of disease-carrying mosquitoes. Tsetse flies are carriers of African sleeping sickness in men and nagana, surra, dourine, etc., in domestic animals. These diseases are caused by an elongated protozoon (trypanosome) in the blood stream. African sleeping sickness and nagana are so deadly that vast areas of Africa are practically uninhabitable because of them. Mosquitoes capable of carrying malaria, yellow fever, jungle fever and several species of parasitic roundworms (fila-

riae) have probably influenced the course of human history. Some authorities believe that the fall of the Roman Empire was

Hog Louse—*Hematopinus suis* (Male)

greatly influenced by malaria undermining the health of both the military and civilian population. It is well known that millions of mosquitoes bred for centuries in the Pontine Marshes surrounding Rome.

Host-Parasite Relationship

The effect which a parasite has on its host and the reaction of the host to the parasite is called the host-parasite relationship. Parasites affect their hosts in various ways, but in most cases (at least under more or less normal conditions), the host builds up resistance that has a tendency to overcome the ill effects caused by the parasite. For instance, dogs as they grow older develop a certain amount of resistance against hookworms, as has been shown experimentally. Some of the parasitic worms inhabiting the intestinal tract of animals produce more damaging effects in young animals than they do in older ones; presumably because their hosts have not had time to build up sufficient immunity. In other cases, well-fed animals may tolerate a relatively large number of parasites without showing any noticeable symptoms, but if deprived of food or if in poor physical condition from other causes, the parasites rapidly gain the upper hand and alarming symptoms begin to develop. This condition is very well exemplified in stomach worm infestation of sheep.

Some species of parasites have become so finely adapted to specific hosts that they are unable to live in or upon others. This condition is found in most of the tapeworms and flukes. Some parasites, more adaptable, are capable of living in a rather wide variety of hosts. Some species of ticks come under this category, although a few of them have limitations so far as suitable hosts are concerned. A classical example of specific host relationship in ticks is found in the Texas fever tick, which lives almost exclusively on cattle. Certain blood-sucking parasites, particularly the Diptera or flies, attack many kinds of warm-blooded hosts. The mosquitoes, fleas and several other blood-sucking parasites, while attacking many species of warm-blood animals, are known to prefer certain individuals, much to the chagrin of those selected.

The Habitat of Animal Parasites

Nothing could be more diversified than the habitat of animal parasites. Practically every organ of the animal body is invaded by one or more species of parasite. Starting on the outside, the skin, hair and external openings are infested by blood-sucking Diptera, ticks, lice, fleas, leaches, mites, and the larvae of parasitic flies. All the

Hog Louse—*Hematopinus suis* (Female)

internal organs are invaded by parasites, chiefly flukes, roundworms, nematodes, and tapeworms. The gastrointestinal tract is a favorite site for many species of protozoa, roundworms, tapeworms and flukes. This part of the anatomy offers a number of advantages; it is easily entered by way of the mouth and it provides an abundant supply of nutriment. Furthermore, the regular voiding of feces aids in the distribution of the parasites' eggs.

Geographic Distribution of Animal Parasites

Animal parasites are widely distributed over most of the earth's surface, in the air and under water, as well as inside of the body of their hosts. Even in the frozen wastes of the Arctic and Antarctic Regions, parasites are abundant wherever suitable hosts are to be found. Even seals and walruses inhabiting the cold seas of the Arctic are infested with parasites; externally by lice, fleas, etc., and internally by parasitic worms. External parasites are able to maintain themselves very comfortably in the coldest climates because the body heat of their hosts keeps them warm.

While the warm tropics may seem to be an ideal place for parasites, this is not necessarily the case, because the intensive heat rapidly dries moisture, which is an essential factor for the development of many species. Anyone who imagines that parasites are lacking in cold climates has not had experience with the myriads of blood-sucking flies that swarm during the short spring and summer months.

The geographical distribution of animal parasites is not only of interest in a general way, but also of considerable importance because the relationship between parasite and host may show the common origin of species living in widely separated parts of the world. Von Jhering (in 1902) was among the first to draw attention to this. His contention was that if two species of hosts are infested by the same or closely related species of parasites, they (the hosts) are of common descent. In other words, he believed that the close relationship of the parasites is an indication that they are descended from a common ancestral form and also that the hosts themselves descended from an ancestral host that was infested by the ancestral parasite. Zschokke (1904) used a similar argument in attempting to explain the distribution of certain species of tapeworms in pouch-bearing (marsupial) animals in Australia.

Probably the best as well as the most convincing evidence of the origin and distribution of animal species is to be observed in the case of protozoa (Opalina) found in the intestines of frogs of the family Leptodactylidae. These frogs are widely separated geographically, being native to semi-tropical America, Australia and Tasmania. The protozoa infesting the intestines of the frogs from tropical America and Australia are so nearly alike that they can be specifically separated only with difficulty. It hardly seems likely that this is merely a coincidence or parallel development. It is more likely that there was at one time a land connection between Patagonia and Australia inhabited by the frogs (and their protozoan parasites), and that they were separated in early times by a division of the continental land masses.

According to Professor Robert Hegner, practically all parasites lend themselves to a study of the origin and distribution of their hosts by their similarity. Kellogg (1905) has used this method in his work on bird lice. Johnson (1914) has studied problems of evolution and zoogeography by the use of flukes and tapeworms, and Darling (1920) has studied the migration of the human race from data of hookworm distribution.

Summarizing, parasites are of tremendous economic and biological interest to man, not only because of the amount of damage they do to us and to our live stock, by themselves and as vectors of disease, but also because of their beneficial effect in destroying and controlling harmful species, and their usefulness in helping to clarify problems of evolution and zoogeography.

Samples for Laboratory Examination

By MARCUS M. MASON, Waltham, Massachusetts
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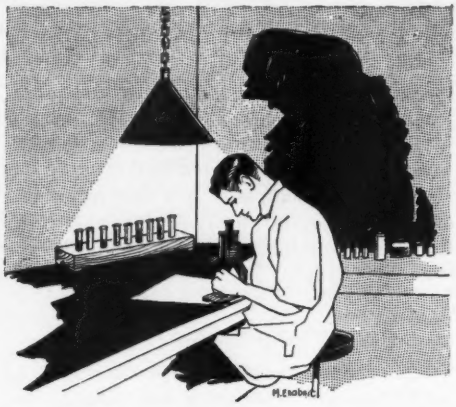
THE MORE autopsies a practitioner performs, and the greater use he makes of scientific diagnostic methods, the clearer and more accurate will his medical science become. Verification of certain diagnoses can be made only by employing various laboratory diagnostic methods. Most veterinary practitioners have neither the time nor equipment to perform the necessary tests. However, nearly every state has a laboratory which does diagnostic work for its veterinarians, most biological houses offer a free diagnostic service, and often the local hospital will offer the use of its facilities.

There are four general considerations for the submission of any sample: selection of the tissue or fluid; preparation or preservation; the container; the informative letter.

The selection of the tissue or fluid for submission depends upon the disease process or the disease suspected. In the case of a tumor, the sample to be submitted is obvious. With an animal which is ill or has died of some disease not easily or certainly diagnosed, the question of what to submit depends upon the diseases suspected. In infectious diseases, portions of the heart, spleen, liver, kidneys and some blood are usually sufficient for diagnosis.

The materials necessary for the preparation and shipment of samples are simple and inexpensive. For the preservation of tissues, 10% formalin is excellent. Formalin, which is 40% formaldehyde, costs approximately 25 cents per pound and one pound will make more than a gallon of the preservative. Pure glycerine is sometimes used for the preservation of parasites or brains; it also costs about 25 cents per pound. Borax powder is very cheap and can be bought at any grocery store. Ice is easily obtainable and very practical. Dry ice, or frozen carbon dioxide, is a refrigerant that is being used more and more. It has the advantages of leaving no water, being low in weight and having very high refrigerating value. Dairies, ice cream



plants and local pharmacies usually have some in stock It may be obtained for as low as four cents per pound.

Obviously formalin should not be used when a bacteriologic examination is desired but borax may be used where the specimens are of considerable size. Where a virus is suspected glycerine is often desirable since it preserves the tissues, inhibits bacterial activity and viruses survive in it for several days or longer. Ice or dry ice is a useful preservative for specimens for various examinations but shipments should be timed not to reach their destination on Saturday afternoon for examination the following Monday.

The containers commonly employed are: screw cap vials, rubber-stoppered vials, friction top tin cans, mason jars, mayonnaise jars, syrup pails, lard pails, large tin pails and butter tubs. Any containers are suitable if clean, strong, water-tight, and capacious. The shipper bears a responsibility for injury that may be occasioned by those who handle his shipment enroute. The container should adequately protect such persons.

An informative letter should precede or accompany every sample submitted to the laboratory. The more detailed and factual the letter is, the more complete and valuable

will be the report of the laboratory. The letter should contain the following information: (1) Age, sex and breed of the animal; (2) history and symptoms; (3) how long after death the autopsy was performed; (4) complete post-mortem findings; (5) size of herd and number of animals affected; (6) what material was sent, how it was prepared or preserved, and what information is desired.

Some examinations take but a few hours, while histological and bacteriological examinations may take from a week to a month. The results of the examination may be clearcut and complete, but are often indefinite. It is up to the practitioner to interpret the findings in relation to the particular situation.

Carcasses and Sick Animals

The sooner after death an examination is made, the more accurate and reliable are the findings. Autolysis due to proteolytic enzymes of the tissues or produced by invading organisms from the intestinal tract, cause changes which make it difficult to determine the actual condition at the time of death.

When a herd is involved, it is well to submit a representative sick animal as well as a dead one. Where it is impractical to submit a large animal for autopsy or examination, the affected parts or representative portions may be sent. In sending live animals the possibility of spreading disease should not be overlooked. To send diseased animals across state lines conflicts with regulations of the Secretary of Agriculture if the sender knows or suspects they are afflicted with an infectious disease.

For specimens as large as or larger than a dog's head, the following procedure may be used:

1. Place the chosen samples in a clean, water-tight container.
2. Place this first container in a second container in which it is surrounded by ice and sawdust, or paper and dry ice. If the samples are packed in natural ice, the outside container should be perforated to allow the escape of water from the melting ice.
3. The bodies of small animals and poultry may be shipped as described above if containers of adequate size, such as galvanized pails, are used. (Poultry shipped in paper or cardboard boxes is usually in such decomposed state when received, as to make examination futile.) Dry ice may be placed directly in with the carcasses; if the container is at all insulated, the specimens will be suitable even after 72 hours.
4. Ship by express, prepaid.

Sick animals afford the laboratory an opportunity to make many necessary clinical examinations such as blood counts and liver and kidney function tests, or to determine the value of certain forms of therapy. A frequent obstacle is the refusal of the express company to ship sick animals, since they may held liable for the death of the animals. However, if the crate or package is labeled "Pathological specimens for laboratory examination," this objection will be avoided.

Laboratory diagnosis is one of medicine's most effective instruments. As veterinary medicine has developed, greater stress has been placed upon accurate diagnosis and the means to accomplish this end. The practice of submitting animals and materials for laboratory diagnosis has increased steadily, but too little attention has been given to the proper handling of this material. This paper deals with the efficient and economical preparation and shipment of samples of tissues, blood, urine, parasites and other materials to the laboratory.

Tissues

Tissues are submitted to the laboratory for bacteriological, histological or chemical analyses. The method of preparation and shipment varies according to the purpose of the examination.

As the autopsy progresses, either one sees various diseased organs or one finds no visible pathology to account for the death of the animal. In the first case, the selection of the desired tissues is obvious. When in doubt, samples of heart, liver, kidney, spleen, intestine, muscle and brain should

be submitted. When a sample of diseased tissue is sent, a normal portion of the organ or part should accompany it.

The submission of fresh or chilled material is preferred, since all the work can be done on this one sample. If this is not possible, the tissues should be prepared as follows:

Fig. 1. The proper package for dogs' heads.—*Baker and Klussendorf—Cor. Vet.*

For Histological Examination.—The most economical and practical preservative is 10% formalin (4% formaldehyde in water). Representative samples of tissue, one-quarter inch thick and small enough to fit easily into the mouth of the jar, should be chosen and formalin up to 25 times the amount of tissue added; the excess of formalin insures proper penetration and preservation. The bottle or jar should be tightly stoppered to prevent leaks. If a cork is used, it is well to secure it by means of cord or adhesive tape. If a water-tight container is not available, the tissue may be shipped in a jar between layers of cotton saturated with the formalin but not dripping.

Brains from animals suspected of rabies or equine encephalomyelitis may be shipped in pure glycerine.

When tissue from the intestines is shipped for histological examination, the contents should be washed out carefully with water and only small representative portions of the intestine placed in the preservative.

For Chemical or Toxicological Examination.—No preservative of any kind should be added. In cases of suspected poisoning, the samples should be collected before a responsible witness and shipped under seal. It is unduly expensive to submit samples for general examination for poisons, unless the laboratory requests the specimens. Examinations of this nature performed by licensed, competent laboratories often cost $25.00 and sometimes more.

For Bacteriological Examination.—Fresh tissue is the best, but tissue powdered with borax, wrapped in cheesecloth, and packed in more borax, usually arrives in good condition for culture. Larger pieces of tissue are preferred for this work. If an intestinal pathogen is suspected, feces should be sent in sterile containers and the portion of the emptied intestine iced or shipped in borax.

Blood

Blood is examined by a variety of technics. The four main divisions are: chemical analysis, total and differential blood counts, detection of infectious agents and pregnancy tests. The bleeding technic varies for both the animal and the amount of blood desired. In large animals, such as the horse, cow or sheep, the jugular vein is the common site of bleeding. In the pig and rabbit, the ear vein is usually employed. The saphenous or radial veins in the dog are very accessible; while in the cat, the vein on the median surface of the thigh can be used. To make a blood smear, a drop of blood may be obtained by drying and then pricking the inside of the lips.

A syringe is commonly used in small animals; in large animals the needle, of about 16 gauge, is inserted and the blood is collected as it flows out of the hub.

Chemical analyses are made to determine abnormalities in the blood constituents, such as low hemoglobin, or high urea content, also to detect poisons such as acetone bodies, alcohol or carbon monoxide. A liberal sample is always requested for these examinations. In order to keep the blood in a fluid state, an anticoagulant is added. The anticoagulants commonly used are sodium citrate and potassium oxalate. These are added as crystals at the rate of about two or three grains to each 5cc of blood.

If a syringe is used, it is well to moisten the barrel with a concentrated solution of oxalate or citrate so that the blood will not clot in the syringe; this also facilitates cleaning it. When only a needle is used to draw the blood, the crystals of anticoagulant are placed in the vial or flask and this is shaken well while the blood is added. Most chemical analyses require whole blood, so it is of utmost importance to keep it from clotting.

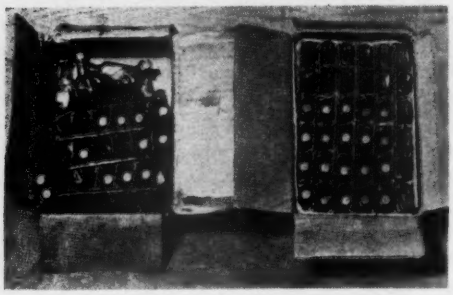


Fig. 2. The filled carton of blood sample vials arrives in good condition.—*Baker and Klussendorf.—Cor. Vet.*

For total blood counts the examination must be made very soon after the blood is drawn; the best procedure is to take the animal to the laboratory. Blood samples for differential counts may be prepared and sent to the laboratory. For these, a drop of blood is placed on one end of a slide and drawn across the surface of another clean slide. If the blood is spread uniformly thin and dried rapidly, it will keep several days until the blood stains can be applied. In shipment, the blood film can be protected by wrapping rubber bands around both ends of the slide and tying a clean slide over the film.

Serum is often used in the detection of infectious diseases, for pregnancy tests, and in determining antibody content. The sample of blood is drawn and allowed to clot at room temperature. The supernatant serum may be poured into another sterile vial or shipped in the original container with the clotted blood. The only requirements are an aseptic technic and dry, sterile vials. No disinfectant should be used on the vials or hemolysis may take place.

For the culture of pathogenic organisms, 1cc of the blood may be drawn and injected into vials of sterile broth. Many biological houses list such material under their blood culture outfits. Larger samples of blood may be chilled or frozen and submitted with good results.

Many laboratories supply upon request sterile vials with rubber stoppers for the collection of samples. If many samples are drawn, each tube should be marked plainly as to the name or number of the animal. The tubes or vials should be separated from each other in the shipping carton by wrapping each one with paper or by using regular cardboard fillers.

Urine

Facilities for urine analysis are so widespread that there is not much need to send samples to a distant laboratory. The important feature is the collection of the sample. Twenty-four hour samples are the only ones from which reliable quantitative data can be obtained. Vaginal discharges should be noted and the catheter should be used in most cases to keep from contaminating the urine with extraneous material. It is best to have a full vial so that there is ample material and not much shaking and frothing. The examination of the urine can be of extreme aid in the detection of acetonemia, diabetes, pyelonephritis and urinary parasites. Two or three drops of formalin added to each ounce of urine will insure against spoilage or fermentation.

Milk

Milk should be collected in sterile containers. Before drawing the sample of milk, the cow's sides and udders should be moistened and the teats disinfected. Discard the first milk drawn and take a generous sample from each quarter. Samples are usually submitted from cases of mastitis or suspected carriers of the septic sore throat organism to examine the bacterial flora and determine the leucocyte count. Iced samples give the best results.

Pus

Pus should be collected and shipped exactly like milk or blood. For cultural purposes, it may be placed in sterile broth. A slide for staining may be prepared just as a blood smear is made.

Parasites

Parasites are usually submitted to a laboratory for identification so that proper treatment can be employed.

External parasites such as ticks, fleas, grubs or lice are usually easy to collect. The mites of sarcoptic and demodectic mange must be secured by clipping away the hair from the affected part and scraping out layers of the epidermis down to the true skin. Scrapings should be made in several places; best results are obtained by scraping at the margin of the lesions. Ear mites are best found by taking samples of detritus in the ear closest to the raw surface. These samples need no preservative. They should be placed in a small wide-mouthed bottle or a small sealed envelope.

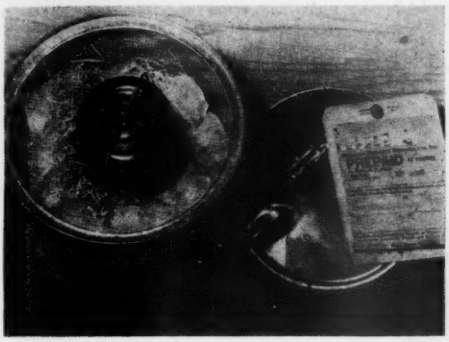


Fig. 3. A good package for shipment of tissues.—*Baker and Klussendorf.—Cor. Vet.*

Internal parasites should be placed in 10% formalin, pure glycerine or 70% alcohol. The entire parasite should be sent, since the heads of certain worms are necessary for their identification.

Feces and Intestinal Contents

The usual examination of this material is for parasites, parasitic ova, occult blood, absence of bile or evidence of depraved appetite.

Samples should be taken from more than one stool or from various portions of the intestines. No preservative need be added. The container should be filled not more than a third full to prevent breakage from gas pressure caused by fermentation. The stopper should be securely fastened.

Agreement Between Extension Service and Veterinary Service

The following agreement has been reached affecting relationship of veterinarians and extension workers in Texas:

1. There should be a continuation of our policy that county agents and other extension workers should confine their activities to the giving of instruction and practical demonstrations in live stock production to persons not attending or resident in colleges in the several communities, and imparting to such persons information on said subjects through field demonstrations, publications and otherwise. The creation of extension work under the Smith-Lever Act made such activities obligatory on the part of extension employees.

2. The policy of the Extension Service that its employees shall not practice veterinary medicine is reaffirmed. County agents and other extension workers are to confine their activities to instructing farmers and ranchmen by the dissemination of the best known information as secured from publications issued by the U. S. Department of Agriculture, the various state experiment stations and other sources of reliable information in the profitable production of live stock.

We recommend that county agents refrain from making calls in the treatment of sick animals, and that they refer the farmers who call on them for veterinary assistance to the local veterinarian.

3. In the event of a seeming outbreak of a contagious disease within a county the county agent shall report such an outbreak to the Director of Extension and at the same time send copies of his report to the Livestock Sanitary Commission and the local veterinarian.

4. That the State Board of Veterinary Examiners furnish the Director of the Extension Service the names of any county agents whom they believe to be practicing veterinary medicine illegally after this date.

5. That the Secretary of the State Board of Examiners furnish the Director of Extension with a list of licensed practicing veterinarians, with their addresses, every time such list is revised and that the Director of Extension likewise furnish the Secretary of the State Veterinary Association of Texas with a list of county agents with their addresses every time such list is revised.

6. That all agencies concerned make special effort to establish a friendly spirit of cooperation and relationship between the two groups to the end that the live stock industry of our state may be more efficiently served.

The 1940 Veterinary Short

1. A consultation of diagnosticians.

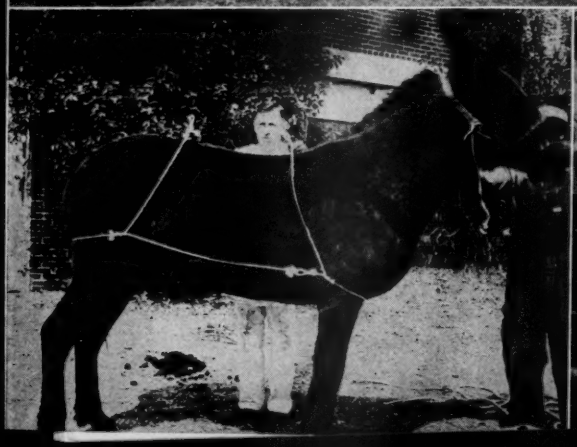
2. Dr. W. L. Stroup (in white) demonstrates a means of restraint for obstreperous patients. L. A. Merillat (left) seems dubious, but T. A. Sigler exhibits complete confidence by standing behind the mule.

3. Doctor Stroup demonstrates a rope sling for raising a downer. A singletree is hooked into the loops he is holding and a block and tackle does the rest. The shoulder and rump loops are put on separately and then connected by the side lines. The side line going under the animal is first connected near the back, then pulled under the animal by rotating the loops. The upper side line is then fastened in place and the hoist hooked on.

4. Dr. Peter Bahsen demonstrates his method of restraining a bad kicker for examination of the legs. Note the enormous tumor on the anterior aspect of the left hind leg.

5. After removing it, Dr. M. R. Blackstock exhibits the tumor shown in No. 4. It had an outer calcareous shell about an inch thick, in the center about two quarts of blood, and the remainder fibrous tissue. The diagnosis was that the growth had developed from a hematoma. The attachment to underlying muscles and tendons was very firm and partly ossified, making separation difficult. The blood supply to the tumor was large, necessitating considerable tying off of arteries. Chloral hydrate intravenously was relied upon for anesthesia, and as usual did not afford complete relief from pain nor permit the operators to forgo other means of restraint. An elliptical piece of skin was removed with the tumor; in fact, too much skin, as after the tumor was removed and the skin had retracted there was some difficulty in making it cover the leg. The consensus was that it would have been better to enucleate the growth without sacrificing any skin.

6. The patient after coming out of the anesthesia. There was considerable oozing hemorrhage for a couple of hours, but not sufficient to require packing the wound. The skin was sutured with a small opening at the bottom for drainage.



Course at Auburn, Alabama

7. Experiment kennels at the Alabama school. The dogs shown are those used by Drs. Salmon and Koehne in their dog food research over a period of more than five years.

8. One of the Whitney portable wire-bottom kennels used at the Auburn school. The dimensions of these kennels are: Overall length, 8 feet; length in front of hutch, 6 feet; width, 3 feet; depth of pen, 2 feet; length of legs, 2 feet; total height, 3 feet. The cover of the hutch is hinged and may be opened for cleaning or examining young puppies. The top, sides and one end of the pen are poultry netting on a 2" x 3" frame. The bottom is heavy 1" square mesh wire netting. A part of the top may be hinged for opening or the wire end may be hinged. The cost of the materials used in construction is about $6.00 per kennel. Puppies born in such kennels and raised to maturity in them have experienced no difficulty with sore feet or parasites.

9. Dr. J. Gilbert Horning, Houston, Tex., a guest speaker, holds a canine clinic.

A Review of the Use of Allantoin and Cod-Liver Oil In Wound Treatment

By J. LA VERE DAVIDSON,
Kalamazoo, Michigan

Allantoin Therapy

The use of living maggots in the treatment of osteomyelitis, abscesses, and non-healing wound infections dates back to antiquity. The Egyptian, Hindu, and Arabian surgeons were familiar with the invasion of gangrenous and slow-healing wounds by maggots, but it is doubtful that they recognized any therapeutic value in the maggots.

The relation of fly-maggots to disease processes is mentioned, perhaps for the first time in the literature, by Ambroise Paré (1510-1590). He observed maggots in gangrenous wounds inflicted during the battle of St. Quentin (1557), and employed a recipe of young larvae boiled in oil of lilies as a dressing for gunshot wounds.

Later, in 1704, Zachman discussed the origin of maggots in wounds, and Larrey, during the Napoleonic wars, observed the healing effects of living maggots in suppurative wounds of soldiers. He was convinced that these larvae accelerated cicatrization and shortened the work of nature by devouring the necrotic cells. He also noted that maggots consume putrid material and do not disturb living tissue.

Malgaigne (1847) mentioned the use of maggots and referred to Larrey's observations. After this time little investigative work was done with this form of therapy until 1928 when Baer[1] of The Johns Hopkins Medical School first used maggots scientifically as living antiseptics in the treatment of chronic pyogenic and tuberculous osteomyelitis. Baer, while serving with the American Expeditionary Forces during the World War, observed that soldiers suffering from compound fractures of the femur with large flesh wounds had no fever or evidence of sepsis, even though they had lain in the battlefield for several days without food or water. In these cases the wounds were filled with blowfly maggots and when cleaned were found to be filled with healthy pink granulating tissue instead of the usual pus and debris.

Livingston and Prince (1932)[2] were among the first to apply an extract of maggots in wound therapy. This extract was obtained by grinding live maggots in sterile saline solution and filtering the product through coarse and fine Berkefeld filters. These authors used a maggot extract prepared in this manner in the treatment of osteomyelitis in two series of patients of one hundred each at the Edward Hines Jr. Hospital in Chicago. These cases were all in adults and were chronic in nature and of long standing, many of them reverting to war injuries. In the first series, they were successful in healing 95%, and in the second, 88% of the cases.

Livingston and Prince had previously found that the maggots cause a rapid rise in pH of the wound and that this causes the death of the maggots, for they observed that as the treatment continues, the larvae live in the wound for a decreasing length of time, and after the fifth application they survive for only a few hours. Messer and McClellan[3] later (1935) demonstrated that this rise in pH was due to ammonia excertion by the maggots and concluded that this aided in healing.

Livingston and Prince claimed to have isolated an active principle from maggot extract, but failed to determine its exact

[1] Baer, W. S., 1931. Treatment of chronic osteomyelitis with maggots. *Jnl. Bone and Joint Surg.* 13, p. 438.

[2] Livingston, S. K. and L. H. Prince, 1932. Treatment of chronic osteomyelitis, with special reference to maggot active principle. *J. A. M. A.* 98, p. 1143.

[3] Messer, F. C. and R. H. McClellan, 1935. Surgical maggots; functions in wound healing. *Jnl. Lab. and Clin. Med.* 20, p. 1219.

[4] Salzmann, H. A. and L. Z. Goldstein, 1938. Treatment of suppurative cutaneous wounds and ulcerations with cod-liver oil and allantoin. *Am. Jnl. Surg.* 40, p. 529.

nature. According to Salzmann and Goldstein[4] this extract contains several active therapeutic agents, including sulfhydryl, calcium, cysteine, glutathione, and allantoin. The sulfhydryl group has been considered a growth-stimulating agent by investigators.

The experience of Livingston and Prince with an aqueous extract of maggots in the treatment of osteomyelitis proved fairly conclusively that the living larvae were not essential in successful treatment of this condition. Robinson,[5] however, was the first to isolate and identify allantoin as the active substance excreted by blowfly larvae. As a result of his findings, allantoin was established as a medical agent in 1935. Allantoin has been employed unknowingly from the earliest times in the treatment of chronic nonhealing suppurative wounds and burns in the form of a plant root, containing about 0.8% allantoin. This plant, commonly known as comfrey and botanically as *Symphytum officinale*, has been recommended by ancient writers in medicine as a dressing for wounds, sores, and ulcers of different types. It has received a traditional reputation among the country folk in England and Ireland for the treatment of ulcerative infections.

Allantoin is the principal end product of purine metabolism in animals below man and the manlike apes, resulting from the oxidation of uric acid by the action of the enzyme uricase. It is prepared synthetically by oxidation of uric acid with potassium permanganate. It is a white, odorless, stable, bland crystalline powder slightly soluble in water and nontoxic.

Kaplan[6] used a solution of allantoin in the treatment of three cases of ulcer, with excellent results. According to his observations, the speed of converting the necrotic base into granulating tissue was remarkable. He also noted that pain ceased almost immediately upon application of the allantoin solution.

Robinson[7] was not as successful with allantoin as with maggots in the treatment of osteomyelitis, particularly in deep-seated infections.

The action of allantoin is due to its hastening of cell formation. It has no antiseptic action. Its effect is believed to be due to stimulation of leucocytosis rather than to any germicidal effect.

The application of allantoin in ointment form has some advantages over the solution. The ointment insures a constant supply of allantoin in direct contact with the wound for a long period. It also eliminates the necessity of frequent dressing changes. In case the solution is being used, it is necessary to change the dressing as often as it dries out. Experiments by Greenbaum[8] convinced him that a greaseless base was more effective when using allantoin in ointment form. He used a 2% allantoin ointment with a triethanolamine stearate glycerine base.

Ambroise Paré (1510-90), generally accorded the title of "Father of Surgery," was the first of record to show consideration for the sufferings of the patient in the treatment of wounds. The behavior of wounds impressed the medicine man of primitive tribes, the barbarian, even the physician of the Middle Ages with the conviction that they must be possessed of demons. And little wonder! With no knoweldge of antisepsis or asepsis and not even a suspicion that invisible organisms might inhabit a wound, the appearance of evil in wounds infected with pyogenic, gas producing, tetanus or other malignant organisms suggested diabolical possession to be exorcised by boiling oil, the red-hot iron, or the most disgusting of applications. It is a far cry from boiling oil and the red-hot iron, human feces, etc., to cod-liver oil and allantoin as wound treatment, but the science of surgery has achieved this transformation in a matter of three centuries.

[5] Robinson, W., 1934. Use of surgical maggots in suppurative infections. *Am. Jnl. Surg.* 25, p. 525.
[6] Kaplan, T., 1937. Allantoin in treatment of ulcers. *J. A. M. A.* 108, p. 968.
[7] Robinson, W., 1935. Stimulation of healing in nonhealing wounds by allantoin occurring in maggot secretions. *Jnl. Bone and Joint Surg.* 17, p. 267.
[8] Greenbaum, F. R., 1936. New granulation tissue stimulating substance; allantoin in ointment form. *Am. Jnl. Surg.* 34, p. 259.

Present indications are that maggot therapy will soon be entirely replaced by the use of allantoin. The use of maggots has several disadvantages as compared with allantoin. There is a natural revulsion on the part of the human patient or the owner of an animal to this form of insect therapy. It is also difficult and quite expensive to secure a ready supply of sterile maggots. There is also the possibility of introducing additional infection such as tetanus. Lastly, antiseptics cannot be used with maggots.

Cod Liver Oil Therapy of Wounds

In 1932, Professor Wilhelm Löhr[9, 10, 11, 12, 13, 14] reported on the value of crude cod-liver oil in the healing of wounds. He obtained remarkable results by application of the oil to ulcers, burns, or any kind of abraded surface. The treated area was held immobile with a plaster bandage. Löhr was led to the local use of the oil because of his previous observations of the wound-healing effect of cod-liver oil in children when taken internally. He noted the increase in granulation in the wound when it was applied locally, and was also aware that, like other oils, cod-liver oil is practically sterile and even has some bactericidal action on the common pyogenic organisms. Since the oil itself is too mobile for applying to wounds, Löhr found it advantageous to combine it with an indifferent fat which did not prevent the oil from permeating the granular tissue and forming an emulsion with its secretion. Under this layer he discovered that bactericidal growth was hindered and bacterial toxins rendered harmless. According to Löhr, the application of this cod-liver salve to a mass of granulations with a pale oozing surface covered with detritus rapidly changes it to a picture of healing. There is an abundant secretion of pus which soon leads to shedding of dead tissue and a sharp demarcation between the healthy and dead tissue.

During a three and one-half year period at the Alstadt Hospital, where Löhr used this method of treatment of burns, no burnt surface was sown with transplants even though the epithelium was destroyed over a surface as large as the back. It is very doubtful whether such success has attended any other method of treatment.

Another advantage of the cod-liver oil treatment is that it is practically painless. However, the odor arising from wounds so treated is disagreeable, a thing which Löhr apparently made no attempt to prevent.

In 1935, there appeared several articles on the therapeutic value of cod liver oil in various combinations for the treatment of cutaneous ulcers. The bactericidal value of cod-liver oil was studied in both animal and human subjects by Tumanski.[15] He observed favorable results from the use of cod liver oil, especially in granulating wounds of the soft tissues. Drigalski,[16] after extensive bactericidal experimentation, found that cod-liver oil has a definite bacteriostatic as well as bactericidal action. He also believes that it tends to hinder the passage of toxins from the wound into adjacent tissues.

Many surgeons have employed cod-liver oil ointment in conjunction with plaster splints in the treatment of compound fractures and in fractures complicated by infected wounds of the overlying soft tissues. The consensus of these observers is that cod-liver oil conduces to healing and aids in the removal of necrotic tissue.

Most writers attribute the healing action of cod-liver oil to its vitamin content, although some believe it is due to the fatty acids present in the oil.

Vitamin A ointments have been used by Horn and Sandor,[17] who believe they inhibit infection and stimulate healing. Lauber and

[9] Löhr, W., 1934. Cod-liver oil for external use. *Deutsche Med. Wchnschr.* 60, p. 561.

[10] Löhr, W., 1934. Combination of cod-liver oil and plaster bandage in therapy of injuries with tissue losses. *Chirurg.* 6, p. 5.

[11] Löhr, W., 1934. Cod-liver oil therapy of extensive burns of 1st, 2nd, and 3rd degress. *Chirurg.* 6, p. 263.

[12] Löhr, W. and K. Treusch, 1934. Bactericidal effect of cod-liver oil and cod-liver oil salve on pyogenic bacteria. *Zentralbl. f. Chir.* 61, p. 1686.

[13] Löhr, W., 1934. Cod-liver oil salve treatment of fresh wounds with or without use of plaster of paris cast. *Zentralbl. f. Chir.* 61, p. 1686.

[14] Löhr, W., 1934. External application of cod-liver oil. *Therap. d. Gegenw.* 75, p. 444.

[15] Tumansky, V. K. and I. A. Yatsevich, 1935. Cod-liver oil in infected wounds. *Klin. Med.* 13, p. 1528.

[16] Von Drigalski, W., 1935. Experimental studies on action of vitamin ointments on wound healing. *Klin. Schnschr.* 14, p. 1614.

[17] Horn, Z. and Z. Sandor, 1934. Local application of vitamin A. *Deutsche Med. Wchnschr.* 60, p. 1018.

Rocholl[18] also found that small and medium amounts of vitamin A added to a cholesterol base accelerated the healing of experimental wounds by 50%. These workers found that larger amounts of this vitamin inhibited recovery, as did other vitamins in various bases. Puestow, Poncher, and Hamatt[19] treated experimentally induced burns on pigs and rabbits with ointments containing various amounts of vitamin A and vitamin D. Burns which averaged 50% larger area than the controls were treated with three ointments high in vitamin content: viz.; one high in D and containing no A, one having a low A to D ratio, and one with a high A to D ratio. The time of healing was approximately 25% shorter than in the smaller control lesions. The response to the various high-vitamin ointments employed was approximately the same. However, these authors observed that of 15 rabbits treated with a very high vitamin D ointment, all but two died within a week, suggesting a toxic effect of this ointment. From these results it would appear that vitamins A and D are equally efficacious in the healing of burns, but that too high concentration of the latter should be avoided due to its toxicity.

Salzmann and Goldstein[20] employed an ointment containing 2% allantoin and 45% cod-liver oil in the treatment of chronic, poorly granulating wounds and ulcerations of the skin, in second and third degree burns, in extensive exfoliative types of dermatitis, and in irritative skin conditions associated with pruritus. This preparation proved beneficial in these conditions by stimulating epithelization and finally accomplishing complete healing. These authors were also able to show that the addition of allantoin enhances the healing properties of cod-liver oil in cases of dermatitis. They applied the ointment at least once a day, covering the treated part with sterile gauze.

[18] Lauber, H. J., 1934. Importance of vitamins in healing of surgical wounds. *Deutsche Med. Wchnschr.* 60, p. 569.

[19] Puestow, C. B., H. G. Poncher and H. Hammatt, 1938. Vitamin oils for burns; experimental study. *Surg., Gynec. and Obstet.* 66, p. 622.

[20] Salzmann, H. A. and L. Z. Goldstein, 1938. Treatment of suppurative cutanous wounds and ulcerations with cod-liver oil and allantoin. *Am. Jnl. Surg.* 40, p. 529.

Summary

Allantoin is an important wound-healing agent in maggot therapy and when used by itself produces the same results without the esthetic and other disadvantages of the use of maggots. It has been found effective in the treatment of chronic slow-healing wounds, ulcers, burns, and osteomyelitis.

Cod-liver oil applied locally has been shown to have a healing action similar to that of allantoin in cases of wounds, burns, ulcers, osteomyelitis, etc.

A combination of allantoin and cod liver oil in ointment form has been shown to be beneficial in chronic, poorly granulating wounds, and ulcerations of the skin; in second and third degree burns; in extensive exfoliative types of dermatitis, and in irritative skin conditions associated with pruritus.

Ultra-violet therapy is another form of treatment often utilized with success in cases of slow-healing wounds or infections. This dog is being treated in the small animal hospital of Drs. Horning and McKee, Houston, Texas, for a badly lacerated ear which failed to heal properly

Further Studies on Moldy Corn Poisoning (Leucoencephalomalacia) in Horses

By H. E. BIESTER and L. H. SCHWARTE,
Veterinary Research Institute
and C. H. REDDY,
Plant Pathology Section
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DURING the years 1934 and 1935, extensive losses occurred in Iowa among horses that were kept in corn stalk fields or were used in the fields during corn husking. The same condition was encountered in horses that were fed moldy corn after harvesting. This disease was reproduced experimentally in horses by feeding moldy corn from the 1935 crop. The pathology of fatal cases of moldy corn poisoning (leucoencephalomalacia) was described and the condition was differentiated from equine encephalomyelitis in a previous report.[1]

Many species of organisms, as might be expected, were present on the moldy corn that produced leucoencephalomalacia. No clue as to the pathogen involved in this disease was observed. For this reason there was little basis for choice of species of organisms with which to experiment. *Trichoderma lignorum, Harz,* was often found on the moldy ears, and because it belongs in that class of fungi which produces powerful poisons affecting other microörganisms,[2] it was grown on sterilized corn and fed to horses. The results were negative. One obstacle that should be kept in mind in an approach to this problem by a continuation of this procedure (i.e., use of one or more of the many organisms found on moldy corn as inoculum) is that, even though the causative organism were used, the toxin might not be produced because of the absence of necessary fungous or bacterial associations, or because the fungus and the corn are not growing at the same time. An illustration of this is found in the case of barley which is infected with *Gibberella saubinetii* (Mont.) Sacc. during the growing stage. Under these conditions a toxin is produced, which when fed to swine causes vomiting. On the other hand, when clean barley is moistened, sterilized and inoculated with *Gibberella saubinetii* a similar toxicity does not always develop. For this reason a more direct attempt was made to eliminate from consideration some of the many microörganisms found on toxic corn. Moldy corn obtained during the fall of 1936 was sorted into two types, one on which the predominating growth was gray and a second on which a green mold predominated. It should be noted that the corn crop of 1936 was not as moldy as that of the two preceding years; this fact, no doubt, accounts for the occurrence of only one death in this experimental series.

On the evening of November 21, 1936, feeding of gray moldy corn and a limited amount of good corn fodder was begun to a group of three horses (Nos. 856, 858 and 859), while at the same time two horses (Nos. 831 and 855) were fed corn showing the green mold. The animals were kept in dry lots having shelters open on one side. A number of horses died during the 1936-1937 season even though the corn harvested in the fall of 1936 was not as uniformly moldy as that of 1934 and 1935. In the fall of 1936 it was necessary to select the moldy ears from the picked corn in order to obtain a grade of moldy corn comparable to that used in the investigations of the previous years. Since we confined our selections of corn to several farms on which horses had died showing lesions of encephalomalacia the supply of available corn was limited. On other farms where horses had died, the available corn was needed for feeding other live stock.

■ Horse 831, fed the selected green moldy corn and a good grade of corn fodder, showed decreased appetite by December 19th. By December 23rd, the consumption of

[1] Schwarte, L. H., H. E. Biester and Charles Murray, 1937. A disease of horses caused by feeding moldy corn. *J.A.V.M.A.* 90:1, pp. 76-85.

[2] Weindling, R., 1938. Association effects of fungi. *Bot. Rev.* 4, pp. 475-496.

feed had increased slightly so that the amount consumed was about half of the original volume ingested. The horse rolled on the ground frequently and constantly rubbed against the wire fence and shelter as though it experienced an irritation of the skin. From December 24th to 30th this animal appeared more depressed and continued to roll often. On the morning of December 31st it was missing from the lot and was found dead in the creek on the Institute farm, having gone through a fence on one side of the lot and through a gate of the adjoining lot, as was evidenced by hair, skin and blood found on the top strands of barbed wire on the fence and gate.

The most significant changes found at autopsy consisted of a large focus of liquefaction necrosis in the white matter of the left cerebral hemisphere. Surrounding this completely liquefied area was a golden yellow zone, which broke down readily when scraped gently with a knife. The microscopic changes in the brain were typical of the lesions found in previous studies of field and experimental cases. Histologic sections of the anterior portion of the spinal cord showed extensive hemorrhages in the horns. The liver was swollen and congested. Histo-

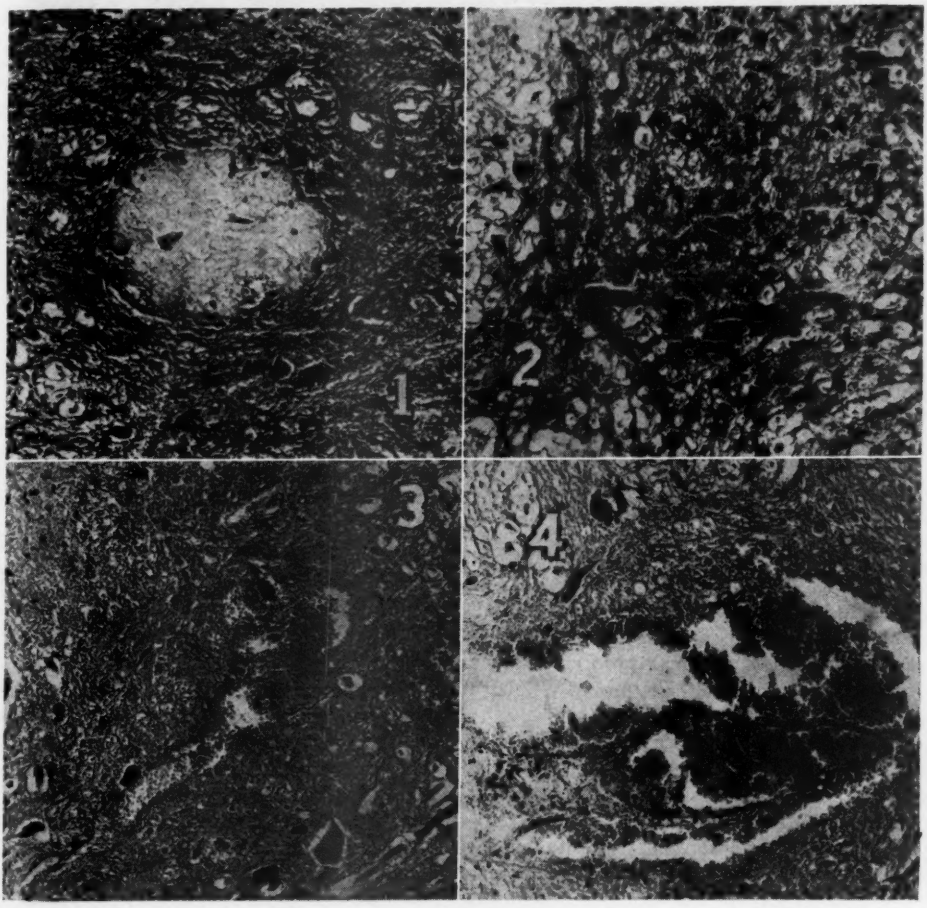


Fig. 1 (top, left). Focus of coagulation necrosis in posterior portion of cerebrum (X150). Fig. 2 (top, right). Edema —spinal cord (X150). Fig. 3 (bottom, left). Hemorrhages in gray matter of spinal cord (X150). Fig. 4 (bottom, right). Degeneration of vascular wall and hemorrhage in spinal cord (X150).

logic sections showed advanced central lobular congestion, epithelial atrophy and pigmentation. The kidneys were swollen and a slight amount of mucoid material was found in the renal pelvis. The microscopic

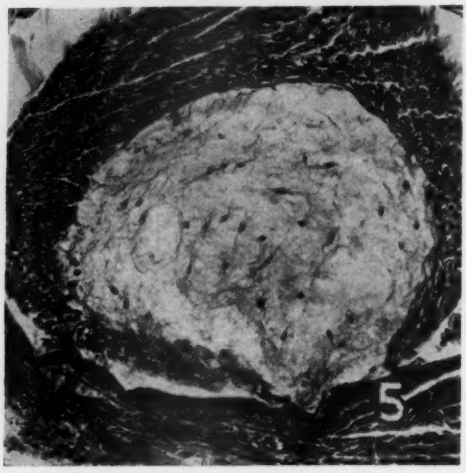


Fig. 5. Myxomatous degeneration of nerve fibers in funiculus of sciatic nerve (X150).

changes consisted of a general congestion. This was especially marked in the glomeruli. Early hyaline formations appeared in some tubules. The bladder contained yellowish mucoid and flocculent material.

The pony (No. 855) also receiving this type of corn (green mold growth) manifested no serious clinical symptoms except that it rolled frequently and appeared irritable when blood samples were taken for chemical analysis. On March 4th, the supply of moldy corn was exhausted and the animal was sacrificed by bleeding from the jugular vein. The pelves of the kidneys contained small quantities of clear mucoid material. Histologic examination revealed intercapillary glomerulonephritis with early hyalinization in some fields. The epithelium of the liver appeared hydropic and granular. A slight amount of pigment was present in some cells. No gross liquefaction was found in the brain. In some areas the white matter was softer than normal. Microscopic examination revealed greatly increased perivascular spaces. Some vessels were surrounded by a marked zone of edema. Many focal hemorrhages were found. Microscopic study of the posterior cerebrum showed round foci of coagulation necrosis (Fig. 1). The spinal cord was considerably softened and the gray matter presented a brownish appearance. Microscopic examination of the various levels of the cord showed edema in the gray matter (Fig. 2). The nerve cells were shrunken. Hemorrhages were noted in both anterior and posterior horns of the cord (Figs. 3 and 4).

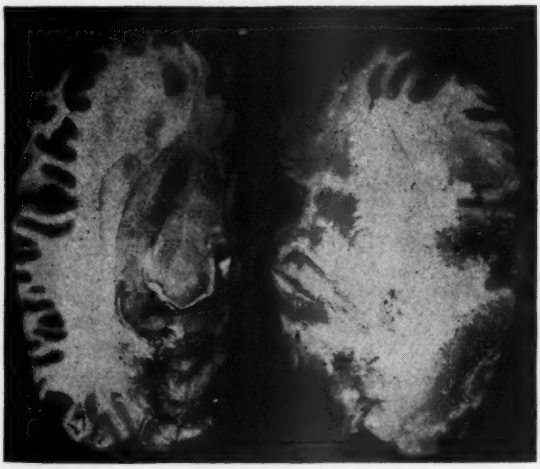
■ Horses Nos. 856, 858 and 859 were fed corn on which a gray mold growth predominated, together with a good grade of corn fodder. After they had eaten this corn for about 18 days, the consumption of feed decreased. At this time (December 9th) horse No. 856 appeared depressed and manifested a slight incoördination in locomotion. On December 13th this animal was down most of the day. On the following day it appeared much brighter and was on its feet again. One week later (December 20th) the three horses in this group consumed slightly increasing quantities of corn and fodder. December 22nd and 23rd, horse No. 858 swayed from side to side while standing, the rear end moving back and forth as if the animal were scratching it on a fence.

The gross and microscopic changes of the group fed gray moldy corn (Nos. 856, 858 and 859) were similar to the changes found in the sacrificed animal (No. 855) which received green moldy corn. In addition to the degenerative changes and vascular disturbances, horse No. 859 presented an unusual pathologic change in the sciatic nerve. Some funiculi showed extensive replacement of fibers by myxomatous material (Fig. 5). In these earlier studies only one or two specimens of sciatic nerve were taken at random from each case for microscopic study. The sciatic nerves of horse No. 859 appeared somewhat soft and pliable. No enlargements or irregularities were observed grossly on the nerves. The process was confined within the involved funiculi. We have found no reference to a lesion of this kind in the available veterinary literature. The preparations were examined by Dr. J. W. Kernohan of the Mayo Clinic, who has observed a similar change in human subjects. A second specimen of nerve from horse No.

859 failed to show a similar alteration. The process was not encountered in sections taken from other experimental and field cases of moldy corn intoxication studied by us. The lesion is provisionally considered as one occurring in later life. No similar change was encountered in several hundred pigs ranging in age from six months to one year.

Summary

An attempt to eliminate some of the numerous organisms present on moldy corn in an effort to determine the one responsible for the toxin causing leucoencephalomalacia failed. One horse, fed the corn on which a green mold growth appeared, died 40 days after the experiment was started. It was also determined that severe microscopic changes are associated with nonfatal cases in which no gross liquefaction necrosis exists. The second horse killed after consuming the same material for 110 days showed marked microscopic changes in the central nervous system. No gross liquefaction was found in the brain, but histologic studies revealed small foci of coagulation, perivascular edema, hemorrhages, evidence of thrombosis and degenerative changes in the blood vessel walls. Similar variations in individual susceptibility were found in a previous feeding experiment.



Longitudinal incision of cerebral hemisphere, showing typical areas of softening, hemorrhage and edema.—*Photo by Graham*

Affected horses may become depressed and lethargic. —*Photo by Graham*

Three horses fed corn showing a gray type of mold growth were killed after a feeding period of 110 days. During this period the animals rolled frequently, gave indications of increased irritability, and at times appeared depressed. One horse presented slight incoördination. At autopsy, no gross liquefaction was found in the brains. The microscopic changes consisted of perivascular edema, retrograde changes in the blood vessel walls, minute foci of coagulation and hemorrhages in the brain. The spinal cords were softened and presented some similar changes.

In one case myxomatous changes were observed in the sciatic nerve; this is considered as a general pathologic process and is not correlated with the toxicogenic factor in the light of our present knowledge.

Feeding tests, using corn experimentally infected with *Trichoderma lignorum*,[8] failed to reproduce the clinical condition described.

The Calcium-Phosphorus Ratio in the

DURING the past 15 years much research work has been done on the mineral requirements of animals. While most of this work has dealt with the mineral requirements of animals other than the equine species, a few feeding experiments with the Equidae have been reported. However, the articles on this subject which have appeared in the literature in recent years are usually discussions of the few research studies, and attempts to correlate and apply to the horse, information obtained in feeding experiments with other species of animals.

The fact that mineral deficiencies may produce disease and defective bone formation in animals is well established. That some species of animals seem to be more susceptible to ill effects from mineral deficiencies than others, is agreed to by most investigators. This is particularly true with respect to the elements calcium and phosphorus.

As a result of the work of Ingle,[1, 2] Niimi,[3] Niimi and Aoki,[4] Sturgess,[5] and Kintner and Holt,[6] it appears that the actual amount of calcium and phosphorus contained in the ration of horses is secondary in importance to the ratio of the calcium to the phosphorus. With reference to the actual amounts of calcium and phosphorus required by horses, the work of Sturgess, and Kintner and Holt, indicates that approximately 17gm of calcium oxide and 28gm of phosphorus pentoxide are adequate for the daily requirement of horses.

Ingle in South Africa was the first (1907) to suggest the theory that osteoporosis of the solipeds is favored by the use of foods, not necessarily deficient in lime and phosphates, but in which the ratio of the lime to the phosphoric acid content is too low.

[1] Ingle, H., 1907. *Jnl. Comp. Path. and Ther.* 20, p. 35.
[2] Ingle, H., 1909. *Tropical Agriculturist*, 32, pp. 448-451.
[3] Niimi, K., 1927. *Jnl. Japanese Soc. Vet. Sci.*, 6, pp. 273-283.
[4] Niimi, K., and M. Aoki, 1927. *Jnl. Japanese Soc. Vet. Sci.*, 6, pp. 345-358.
[5] Sturgess, G. W., 1928. *Administrative Report of the Government Vet. Surg. for 1927, Columbo, Ceylon.*
[6] Kintner, J. H., and R. L. Holt, 1932. *Philippine Jnl. Sci.*, 49:1.

The feeding experiments conducted by Sturgess, Niimi, and Kintner and Holt, added conclusive evidence to Ingle's theory, and it is now an accepted fact that when a ration contains a large amount of phosphorus as compared with calcium, the body reserve of calcium of the skeleton is drawn upon, and defective or imperfect bone results. Commenting on the changes which occur in bone as the result of a wide calcium-phosphorus ratio, Sir Arnold Theiler[7] stated: "The concentration of calcium and inorganic phosphorus in the blood is normally kept at a fairly constant level. When the supplies in the food are insufficient, the skeleton is called upon to keep the level of blood calcium within normal physiological limits, so that whenever the body goes into 'negative' balance, either for calcium or for phosphorus, the skeleton begins to suffer. The osseous tissue is broken down to liberate the required elements, and defects or cavities are left in the texture of the 'tela ossea'." Theiler[8] stated further: "In the case of osteodystrophic fibrosa of the horse, we may suppose that the excess phosphorus in the causal diet is absorbed into the blood stream, and that its subsequent elimination imposes a drain on the calcium reserves of the skeleton. Skeletal tissue is absorbed, and then rebuilt on a reduced scale on a different architectural pattern, which requires only half the calcium in the original structure. This results in a correspondingly light skeleton, for which the reduced calcium resources are still sufficient, and which is more or less completely calcified. But since the new fabric is lighter and more fragile, it is not sufficiently strong to resist traumatic influences, or the normal stresses and strains of certain functional activities." Schmidt[9] after discussing pertinent feeding experiments in connection with mineral deficiency diseases states: "The excess phosphorus, in being eliminated from the body, carries with it a large portion of the calcium reserve of the bones. That this is possible was clearly

[7] Theiler, Sir Arnold, 1934. *Vet. Jnl.*, 90:4.
[8] Theiler, Sir Arnold, 1934. *Vet. Jnl.*, 90:5.
[9] Schmidt, H., 1940. *J. A. V. M. A.*, 96:757.

Ration of Horses

By LT. COL. JOHN H. KINTNER, V.C.
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shown by Scheunert and his co-workers in the horse. They found large amounts of calcium reserve being excreted from the body when excess phosphorus was fed. This causes a weakening in the structure of the bone and, ultimately, the symptoms manifested by the animal."

Due to the feeding of cereal grains and, in some sections of the country, grain hay, both of which are comparatively high in phosphorus and low in calcium, a wide ratio of calcium to phosphorus is likely to obtain in the rations of horses and mules. This is particularly true if the drinking water furnished the animals is low in calcium content.

Niimi, and Niimi and Aoki, were able to produce osteomalacia in experimental horses in five months when the ratio of calcium oxide to phosphorus pentoxide was approximately 1:13; the disease did not develop in an eight-month feeding period when the ratio was approximately 1:1.5. In the feeding experiments of Sturgess, osteomalacia was produced in five horses by feeding a ration in which the ratio of calcium oxide to phosphorus pentoxide ranged from 1:5 to 1:18. The control animal used in this experiment received a ration in which the ratio was 1:2 and this animal, after 14 months, showed a "slight suspicion of commencing enlargement" of the inferior maxilla. In the work of Kintner and Holt, it was found that osteomalacia developed in approximately 10% of a group of 31 normal animals after a nine-month feeding period when the ratio was 1:2.9, and that the disease did not manifest itself in normal animals after a nine-month feeding period on a ration in which the ratio was 1:1.9. Further, it was demonstrated that osteomalacia would progress in affected animals fed a ration in which the ratio was 1:2.3, 1:2.4, 1:2.5 or 1:3.0, and the disease process was arrested when the ratio was 1:0.9, 1:1.0 or 1:1.4.

As will be seen from the above, osteomalacia, termed more recently osteodystrophia fibrosa (softening of the bones), may be produced when the ratio of calcium oxide to phosphorus pentoxide is between 1:2.9 and 1:18; it is not produced when the ratio is 1:1.9.

The symptoms of osteomalacia are attributed primarily to depletion of the skeleton of its mineral content by the process of resorption. While some writers suggest that such conditions as arthritis, spavins, ringbones, splints, separation of tendons from their attachments, spontaneous fractures, etc., may be due to depletion in the skeleton of minerals, others are not in accord with this view. The arthritis seen in osteomalacia is, presumably, an osteogenic process caused by resorption of calcium salts from the bone just beneath the articular cartilage. A type of arthritis which had been diagnosed as osteomalacia among Army animals in Panama was found by Kelser and Callender[10] to be a degenerative arthritis originating in the articular cartilage and unassociated with osteomalacia. Mechanical irritation applied to bone which has been depleted in its minerals may be the inciting cause of exostoses. The strength of tendons at the point of their attachments is certainly affected by the quality or strength of the bone itself. Experiments have shown that the tensile strength of bone is influenced by its mineral content. Bohstadt, Bethke, Edgington, and Robison[11] in experimental work with the bones of swine showed that a positive correlation existed between the mineral or ash content and the breaking strength. In the work carried out by Kintner and Holt in the Philippines, it was found that the metacarpal bones of horses affected with osteomalacia showed a reduced mineral or ash content, and that in these bones the tensile strength was reduced as much as 31%.

It appears, therefore, that the quality, density, or strength of the bones of horses is based on their mineral or ash content, and that the mineral or ash content is influenced by the proportion of calcium to phosphorus in the animal's ration.

[10] Kelser, R. A., and G. R. Callender, 1938. *Vet. Med.* 33:7.
[11] Bohstadt, Bethke, Edgington and Robison, 1926. Ohio Agri. Sta. Bull. No. 395.

Present Investigation

The present investigation was undertaken in an effort to determine the influence of a comparatively narrow calcium oxide:phosphorus pentoxide ratio on normal bone, with reference to the quality of bone, as determined by its ash content, and the relationship of exostoses to the mineral content of equine bone.

The physical changes which occur in bone may be studied during the course of a feeding experiment by means of x-ray examinations. This was demonstrated in the research work carried out by Kintner and Holt in the Philippines. Chemical changes of bone are usually observed by comparing specimens, collected at autopsy, of animals which have been fed on mineral-deficient rations, with those of animals fed on rations adequate in minerals. In experiments of this kind it is necessary to assume that all animals of the test group are normal at the beginning of the experiment and that the mineral content of their bone is approximately the same. In the present experiment, specimens of bone were removed from all animals of the group immediately prior to and during the feeding test by trephining the superior maxillary sinus. This operation provides for analysis discs of bone about one inch in diameter and weighing approximately one gram each, and enables the investigator to follow, with a high degree of accuracy, the chemical changes which occur in the bone of each animal. At the completion of the test period three of the animals were destroyed, and discs of tissue were removed from the previously trephined areas in order to determine the rapidity of bone replacement. The ash content of the bone specimens was determined on a moisture-free, fat-free basis, by drying the specimens to a constant weight at 100°C. and then extracting with anhydrous ether for a period of 24 hours. Ashing was accomplished at 910° to 920°C.

Gomez and Gonzaga[12] described an instrument used by Iizuka in Japan for the diagnosis of osteomalacia in horses. It consists of a pointed stylet attached to a handle and a positive test is based on the density of the bone as indicated by the ease with which the stylet can be inserted into the frontal sinus. Based on this report, a penetrometer was devised consisting of a pointed stylet attached to a metal cylinder which was filled with glycerin and equipped with a maximum-reading pressure gauge. Pressure on the gauge, which was used as the handle of the instrument, was transmitted to the pointed stylet and the maximum pressure required for penetration was then recorded on the gauge. It was apparent that an instrument to determine mechanically the bone density would be of value during the feeding experiment. The instrument was tested on a number of normal animals by forcing the stylet through the facial bone and recording the pressure. It was found, however, that the amount of pressure required to penetrate the facial bone of an animal when inserted at various points within an area of one square inch, varied as much as 100%. The instrument, therefore, was considered to be of no value for the purpose of testing bone density.

[12] Gomez, A. K., and A. C. Gonzaga, 1938. *J. A. V. M. A.*, 93:4.

Feeding Test

Five thoroughbred horses, all of which had been raced or had been trained for racing, were used in the test. Examination of the feces showed that all animals of the group were infested with strongyles, and treatment with carbon tetrachloride was administered prior to and once during the test period. All animals of the group were maintained under similar conditions; they were fed twice daily, watered frequently, and exercised by turning out into a large corral where they were exposed to sunshine. Chemical analysis of the drinking water showed a calcium content of 23 parts per million. Salt in the form of compressed blocks was available to the animals at all times.

To provide a ration in which the mineral intake of the animals was more or less constant, sufficient feed from one source was procured for the entire test period, and numerous chemical analyses were made during the course of the experiment. A basal ration was fed all animals of the group and the following table indicates the amount of feed per animal, the average calcium and phos-

phorus content, and the daily mineral intake per animal:

TABLE I. COMPOSITION OF BASAL RATION

Feed	Am't	% Ca	% P	Grams Ca O	Grams P_2O_5
Oats, White, No. 2	6 lbs.	0.07	0.31	2.82	19.32
Mixed Feed	2 lbs.	0.26	0.29	2.36	6.02
Hay, Red Oat, No. 1	12½ lbs.	0.19	0.15	15.08	19.48
Total				20.26	44.82

The mixed feed was used primarily as a vehicle for the mineral supplement, to prevent its sifting out and subsequent loss. This feed was prepared as follows:

White Oats, rolled, No. 2.....250 lbs.
Yellow Corn, cracked, No. 2.....100 lbs.
Alfalfa Leaf Meal..... 30 lbs.
Linseed Meal (O.P.)..... 20 lbs.
Molasses, cane ..... 2 gal.

The dry ingredients were mixed thoroughly. The molasses was warmed, diluted with an equal volume of hot water, sprinkled over the dry feed, and mixed thoroughly.

Based on an average daily consumption of six gallons of water, the calcium oxide-phosphorus pentoxide ratio for animals fed the basal ration was approximately 1:2.1.

Calcium carbonate in the form of finely ground limestone, known commercially as "limestone flour," was used as a mineral supplement to adjust the calcium-phosphorus ratio. This product was of a fineness that 99.7% would pass through a No. 325 sieve; chemical analysis showed a calcium carbonate content of 98.2%.

Two of the animals of ths group were fed the previously-described basal ration, which provided a calcium oxide-phosphorus pentoxide ratio of approximately 1:2.1; two were fed the basal ration to which was added 22gm ground limestone daily, making a ratio of approximately 1:1.4; and one was fed the basal ration plus 45gm ground limestone daily, which provided a ratio of 1:1. Feeding of the test rations was begun January 6, 1940. Description of the animals and details of the test follow.

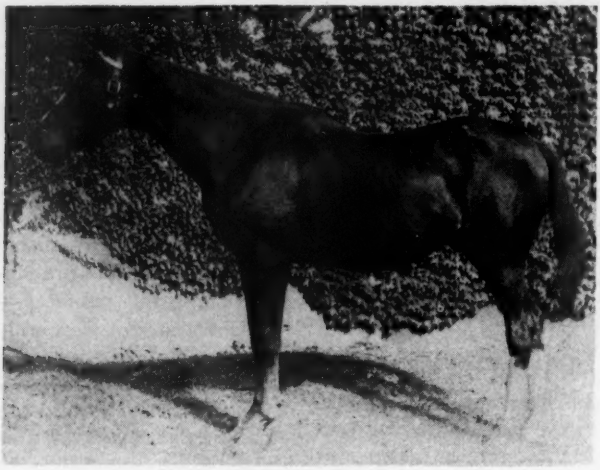
Animal No. 1.—Sex, gelding; color, chestnut; age, four years; weight, 850 pounds; general condition, good. The animal had been in training for racing, but because of poor conformation, did not train successfully. The blood serum contained 11.9mg of calcium and 4.3mg of inorganic phosphorus per 100cc. January 5, 1940, a section of bone removed from the right maxillary sinus showed an ash content of 65.59%. Feeding of the basal ration, which provided an intake of 20.8gm calcium oxide and 44.8gm phosphorus pentoxide was started January 6th; the ratio of this ration was approximately 1:2.1. March 21st, a section of bone removed from the left maxillary sinus showed an ash content of 65.19%. The animal was destroyed April 23rd; the maxillary bone at this time showed an ash content of 65.23%. Discs of replacement tissue removed April 23rd from the areas which had been trephined January 5th and March 21st showed an ash content of 55.80% and 14.31% respectively. During the feeding experiment the general condition of the animal had improved and the weight had increased about 50 pounds.

Animal No. 2.—Sex, gelding; color, black; age, eight years; weight, 1050 pounds. This animal had not been raced for several years and showed chronic lameness, due probably to mechanical interference of a prominent ringbone on the left front pastern. The animal had been on pasture for some time prior to the test. The blood serum contained 12.1mg of calcium and 4.0mg of inorganic phosphorus per 100cc. A section of bone removed by trephining the right maxillary sinus January 5th showed an ash content of 64.36%. Feeding of the basal ration was started January 6th. The left maxillary sinus was trephined on March 21st and the section of bone removed showed an ash content of 64.77%. The animal was destroyed April 23rd; the maxillary bone at this time showed an ash content of 64.96%. The discs of replacement tissue removed April 23rd from the areas which had been trephined January 5th and March 21st showed an ash content of 57.90% and 16.60% respectively. During the experiment the general

"The observations on the association of various types of diseases of bone and other tissues with the nervous system and experiments carried out on the effect of imbalance of some of the essential mineral and vitamin content of everyday horse feeding will, doubtless, lead to a clearer understanding of some of the more obscure diseases and enable the practitioner to advise on this subject."—*T. Dalling*, University of Cambridge.

condition of the animal had improved and the weight had increased about 65 pounds.

Animal No. 4.—Sex, gelding; color, chestnut; age, eight years; weight, 900 pounds;



"Kidran," age 31 years. Private mount of General John J. Pershing

Animal No. 3.—Sex, mare; color, bay; age, four years; weight, 900 pounds. This animal was one of outstanding breeding, had been raced (unsuccessfully) in November, 1939, and was in racing condition when acquired. On physical examination the animal appeared to be sound, but was thin in flesh and had a very nervous temperament. This history indicated that when in training for racing, it became very nervous, would not consume the full ration allowance, and lacked stamina in racing. The blood serum contained 11.5mg of calcium and 3.9mg of inorganic phosphorus per 100cc. The animal was trephined January 5th and the section of bone removed from the right maxillary sinus showed an ash content of 64.25%. Feeding of the test ration was begun January 6th. It consisted of the basal ration to which was added 22gm ground limestone daily. This provided a calcium oxide intake of 32gm and a phosphorus pentoxide intake of 44.8gm, the ratio being 1:1.4. A section of bone removed by trephining the left maxillary sinus March 21st showed an ash content of 64.73%. Examination April 30th showed that the general condition of the animal had improved, body weight had increased approximately 50 pounds, appetite had improved, and the animal appeared to be less nervous. May 1st the mineral supplement of calcium carbonate was increased to 45gm daily, reducing the calcium oxide-phosphorus pentoxide ratio to 1:1.0. June 1st the animal appeared to have lost its nervousness and conditioning for racing in the fall of 1940, was begun.

general condition, good. The animal had been on pasture for several months, and had not been raced during 1939. The blood serum contained 11.7mg of calcium and 3.6mg of inorganic phosphorus per 100cc. This animal was trephined January 5th; a section of bone removed from the right maxillary sinus showed an ash content of 64.02%. The test ration, begun January 6th, consisted of the basal ration to which was added 22gm ground limestone daily. This provided a calcium oxide intake of 32gm and a phosphorus pentoxide intake of 44.8gm; the ratio being 1:1.4. A section of bone removed from the left maxillary sinus March 21st showed an ash content of 64.66%. This animal was destroyed April 23rd; the maxillary bone at this time showed an ash content of 65.23%. Discs of replacement tissue removed from the areas which had been trephined January 5th and March 21st showed an ash content of 63.75% and 17.95% respectively. During the feeding period the general condition of the animal had improved greatly, and an increase in weight of approximately 80 pounds was noted.

Animal No. 5.—Sex, gelding; color, chestnut; age, six years; weight, 900 pounds; general condition, good. This animal had been raced five times in 1937, 19 times in 1938, 11 times in 1939, and was in training when placed in the feeding test group. On physical examination January 5th the animal exhibited a marked acute lameness of the left front fetlock, attributed to exostoses of this region; the part was enlarged and showed

considerable heat. The right front fetlock likewise showed a prominent bony enlargement. Old scars from "point firing" were evident on both front fetlocks. The animal displayed marked nervousness and was a pronounced, habitual "weaver." The calcium content of the blood serum was 12.2 mg and the inorganic phosphorus 4.2mg per 100cc. A section of bone removed from the right maxillary sinus January 5th showed an ash content of 62.11%. January 6th this animal was placed on the basal ration, to which was added 45gm of ground limestone daily, providing a calcium oxide intake of 45gm and a phosphorus pentoxide intake of 44.8gm, a ratio of 1:1.0. March 21st the ash content of a section of bone removed from the left maxillary sinus was 63.51%. Physical examination on April 30th showed that the general condition of the animal had improved, weight had increased about 50 pounds, and all evidence of lameness had disappeared. During the course of the experiment it was noted that the "weaving" habit of the animal was becoming less marked and by April 15th it had disappeared completely. The nervous condition gradually improved. May 1st this animal was placed in training for racing and after six weeks of daily exercise, consisting of gallops up to four miles and speed trials of four furlongs, the animal remained sound and no evidence of "weaving" reappeared, in spite of approaching "peak" condition and complete change of environment.

Results of Feeding Test

The following table indicates the results obtained in the test:

horses (Nos. 1 and 2) fed for a period of 109 days on a ration in which the calcium oxide:phosphorus pentoxide ratio was 1:2.1, very little change occurred in the mineral content of the bone; one showed a decrease of 0.4%, while the other showed an increase of 0.6%. One animal (No. 3) fed for a period of 76 days on a ration in which the ratio was 1:1.4, showed an increase of 0.5% in the ash content of the bone, and one animal (No. 4) fed on the same ration for a period of 109 days showed an increase of 1.2% in bone minerals. A ration in which the ratio was adjusted to 1:1.0 was fed to one animal (No. 5), and the bone minerals of this animal showed an increase of 1.4% after a feeding period of 76 days.

3. As shown in Table II, considerable difference was noted regarding the rapidity with which replacement of bone occurred in the areas which had been previously trephined. Animals Nos. 1 and 2, fed a ration in which the calcium oxide:phosphorus pentoxide ratio was 1:2.1, showed replacement tissue containing 14.3% and 16.6% ash respectively, after a 76-day feeding period, and 55.8% and 57.9% respectively, after a 109-day feeding period. One animal (No. 4), fed a ration adjusted to 1:1.4, showed 63.7% after a 109-day feeding period and 17.9% after a 76-day period.

Table II. Results of Feeding Test

ANIMAL No.	Age	RATIO* $CaO:P_2O_5$	ASH OF BONE Jan. 5	Mar. 21	April 23	INCREASE OR DECREASE**	ASH CONTENT REPLACEMENT TISSUE—APRIL 23 Jan. 5†	Mar. 21‡
1	4 Yrs.	1:2.1	65.59	65.19	65.23	—0.4%	55.80	14.31
2	8 Yrs.	1:2.1	64.36	64.77	64.96	+0.6%	57.90	16.60
3	4 Yrs.	1:1.4	64.25	64.73	—	+0.5%	—	—
4	8 Yrs.	1:1.4	64.02	64.66	65.23	+1.2%	63.75	17.96
5	6 Yrs.	1:1.0	62.11	63.51	—	+1.4%	—	—

*Ration started January 6, 1940.
**Animals 1, 2 and 4 after 109 days; 3 and 5 after 76 days feeding period.
†After 109 days on test ration.
‡After 76 days on test ration.

1. All animals showed an improvement of general condition and an increase of weight.

2. The results shown in Table II indicate that the ash content of the bone was within normal limits in all instances, with the possible exception of animal No. 5 (62.11%), which may be considered a low normal value. Analysis made of the bone of normal horses in the Philippines showed values ranging from 61.50% to 65.11%. Of the two

4. In one animal (No. 5) affected with two pronounced exostoses, one of which showed an acute inflammation, the bone ash was the lowest of the group—62.11%. This animal was a pronounced "weaver," the manifestations of which were unceasing. After a feeding period of 76 days, during which the ration contained calcium oxide and phosphorous pentoxide in the ratio of 1:1.0, the bone ash was 63.51%, an increase

of 1.4%, and the lameness disappeared. The weaving habit subsided gradually and disappeared completely by April 15th.

"Jeff," age 30 years. Private mount of General John J. Pershing

5. The improvement noted in animals Nos. 3 and 5 appeared to justify retention of these animals for racing purposes. They have been returned, therefore, to training for racing as a practical test to determine improvement, and will be continued on a ration containing calcium oxide-phosphorus pentoxide components at a ratio of 1:1. Further data on these animals will be obtained.

6. The serum calcium of the group of experimental animals ranged from 11.5mg to 12.2mg, with a group average of 11.9mg per 100cc; and the inorganic phosphorus from 3.6mg to 4.3mg, with a group average of 4.0mg per 100cc.

7. Negative results were obtained when a penetrometer was used to determine the density of facial bones.

Discussion

Previous investigations have shown that the calcium intake of horses is of secondary importance to the proportion of calcium to phosphorus and that the average daily calcium oxide requirement of the horse is about 17gm. It appears from the results obtained in the present investigation that a ration which provides a calcium oxide-phosphorus pentoxide ratio of 1:2.1 may or may not be satisfactory. It is a well known fact that considerable differences exist among animals in their resistance to changes in the bone, and it is entirely possible that a ratio of 1:2.1 may prove to be an unfavorable one in many instances. A ratio of 1:1.4 appeared to be more favorable for increasing the mineral content or density of the bone, as in this instance, both animals of the group showed an increase of ash of 0.5% and 0.6% respectively, after 76 days, while the one animal which was continued on the ration for 109 days, showed an increase of 1.2%. A ratio of 1:1.0 in one animal showed the greatest increase in mineral content of the bone (1.4%) after a feeding period of 76 days. The bone of this animal at the beginning of the experiment, however, contained the smallest amount of mineral matter, so that when placed on a favorable ratio the greatest increase would be expected. It is interesting to note that this latter animal was suffering with an acute lameness due to pronounced exostoses, and showed marked nervous irritability; recovery from both of these conditions took place in a comparatively short time. While no specific evidence is presented to show that exostoses are related to an unfavorable calcium-phosphorus intake, and in this instance the association of exostoses with bone

of low mineral content may be purely coincidental, it appears reasonable to assume that mechanical irritation applied to bone which is low in minerals may result in proliferation of the bony structure. Further, the recovery of this animal from marked nervous irritability as displayed by "weaving" may be purely coincidental. However, it has been recognized for a long time that a reduced calcium intake increases irritability of the nervous system, and the fact remains that complete recovery did occur when the animal was placed on a narrow calcium-phosphorus ratio.

The difference in the rapidity of replacement of bone tissue, with respect to the calcium:phosphorus ratio, is considered significant. A calcium oxide-phosphorus pentoxide ratio of 1:1.4 resulted in a more rapid replacement of destroyed bone tissue than a ratio of 1:2.1. However, the increased intake of lime may have been a factor in this instance; a review of the available literature failed to show any research work regarding the influence of the calcium-phosphorus ratio in bone repair.

Prior to the present investigation, chemical analyses were made of samples of red oat hay collected from several sections of California, and it is interesting to note the wide variations which occur in the mineral content of this forage. Numerous authorities have called attention to the variations in forage, stating that the mineral content of feed varies, depending on the type of soil on which it is grown, the amount of rainfall during the growing period, the stage of maturity at which it is harvested, and other conditions. Table III shows the complete chemical analysis of 27 samples of red oat hay, and is included in the present report as a matter of record and to illustrate the variations found.

It is interesting to note the wide variations found in the mineral content of red oat hay and, as stated previously, in order to limit this variation as much as possible in the present experiment, sufficient forage for the entire feeding test was obtained from one source, and frequent analyses were made during the test period. It may be noted from Table III that the calcium content varies from 0.03% to 0.29%, and the phosphorus from a low of 0.06% to a high of 0.24%. The calcium oxide-phosphorus pentoxide ratio in the samples analyzed varied from 1:0.13 to 1:6.5. It can be seen, therefore, that a ration composed of red oat hay low in its calcium content and high in its phosphorus component, and oats, which are

TABLE III. ANALYSIS OF RED OAT HAY

HAY	Total Dry Matter	Protein	Ash	Calcium	Phosphorus	Ether Extract	Crude Fiber	Nitrogen Free Extract
No. 1 Red Oat, Albers, Upland	97.84	6.54	5.10	0.20	0.17	3.04	25.35	57.81
No. 1 " " , Blk Soil, "	89.07	4.79	8.00	0.21	.16	3.75	20.75	51.81
No. 1 " " , Russel, "	92.30	4.74	6.50	.15	.14	2.71	25.09	52.90
No. 1 " " , Albers, "	87.13	4.49	8.04	.10	.09	1.97	26.02	46.61
No. 1 " " , " "	87.70	4.69	5.76	.25	.13	1.50	23.78	41.97
No. 1 " " , " "	86.82	3.19	4.80	.09	.09	2.41	21.71	54.71
No. 1 " " , San Joaquin V.	88.24	5.27	6.13	.24	.24	3.82	23.70	49.32
No. 1 " " , Hayward V.	88.93	3.52	5.03	.18	.12	2.94	24.49	52.95
No. 1 " " , Pleasanton V.	88.62	4.16	5.03	.12	.13	3.48	23.59	52.36
No. 1 " " , Altamont Hills	89.18	5.56	7.48	.15	.13	3.18	22.67	50.29
No. 1 " " , Sonoma, Upland	87.81	5.82	6.26	.06	.13	3.73	20.45	51.51
No. 1 " " , " "	88.68	5.47	6.48	.06	.11	3.38	22.61	50.70
No. 1 " " , " "	86.47	5.45	5.04	.06	.13	4.55	21.85	49.58
No. 1 " " , " , Marsh	86.74	4.93	5.27	.03	.06	3.04	25.48	44.02
No. 1 " " , " "	83.43	5.50	5.57	.04	.08	2.47	23.65	46.24
No. 1 " " , " "	88.19	5.44	5.98	.04	.08	2.35	25.40	49.02
No. 1 " " , " , Upland	89.61		6.62	.29	.10			
No. 2 " " , Albers, Marsh	97.80	5.63	7.24	.06	.13	2.80	25.76	56.37
No. 2 " " , " , Upland	97.95	6.70	4.32	.14	.13	3.30	24.82	58.81
No. 2 " " , " , Marsh	79.45	5.39	7.91	.07	.10	2.28	23.01	40.88
No. 2 " " , " , Upland	85.78	5.08	5.26	.22	.09	1.80	24.11	49.53
No. 2 " " , San Joaquin V.	88.89	2.97	5.28	.18	.12	2.59	27.06	50.99
No. 2 " " , Livermore V.	88.64	3.96	5.06	.21	.21	3.38	25.65	50.59
No. 2 " " , San Joaquin V.	88.72	4.24	7.90	.06	.24	1.90	30.60	54.08
No. 2 " " , " "	89.53	3.88	5.21	.21	.23	2.55	27.57	50.32
No. 2 " " , " "	88.29	4.28	5.96	.21	.14	2.35	27.44	48.26
" " , Sample Grade	89.07	4.01	4.76	.17	.12	2.05	26.24	51.91

invariably low in calcium and high in phosphorus, may result in a ratio as wide as 1:10. Further, the amount of calcium in such a ration would be far below the minimum requirement for horses.

In the present investigation it was determined that the drinking water furnished the animals contained 23 parts of calcium per million. The importance of considering the calcium content of the drinking water, when evaluating the causes of disturbed metabolism, of bone and in balancing mineral intake, was demonstrated in the research work carried out in the Philippine Islands where it was found that the highest incidence of osteomalacia occurred at Army Posts which had the lowest amount of calcium (9.7 parts per million) in the water supply. Based on an average daily consumption of six gallons of water, the horses used in the present investigation received 0.7gm of calcium oxide per animal daily. In some sections of the country the water contains 200 parts per million of calcium, or more, and the intake of calcium oxide through the drinking water may exceed 6.0gm per day. It is readily apparent, therefore, that the amount of calcium contained in the drinking water should be taken into consideration when calculating the calcium-phosphorus ratio.

Finely ground limestone was used in the present experiment to adjust the calcium-phosphorus ratio. Ground limestone has been demonstrated by investigators to be a desirable source of calcium. The opinion sometimes expressed that minerals supplied naturally through the feed are assimilated better than mineral supplements is not supported by scientific facts. Mitchell and McClure[13] express the opinion that the mineral elements contained in feed are no better utilized than those of mineral supplements, and are generally less well utilized.

The serum calcium and the inorganic phosphorus were within normal limits in all animals of the group notwithstanding the fact that one animal of the group (No. 5) showed a bone ash (62.11%) which might be considered either a low normal or a subnormal value. This adds further evidence to the theory that the calcium and phosphorus content of the blood stream will remain within fairly narrow limits at the expense of the skeleton.

[13] Mitchell, H. H., and F. J. McClure, 1937. Bull. Nat. Research Council, No. 99.

Summary

1. A method is presented for determining changes in the bone tissue of horses, during the course of an experiment. This method should prove valuable in further determining the relationship of exostoses, arthritis, and other bone defects to the mineral content of the bone.

2. A ratio in which the calcium oxide-phosphorus pentoxide ratio was adjusted to 1:1.4 and 1:1 by use of ground limestone, resulted in greater increases in bone minerals than a ration in which the ratio was 1:2.1.

3. A ratio of 1:1.4 appeared to favor replacement of destroyed bone more rapidly than a ratio of 1:2.1, although the increased intake of calcium in this instance may have been beneficial.

4. Negative results are reported on the use of a penetrometer to determine bone density.

5. The relationship of the calcium:phosphorus ratio of the ration to exostoses is discussed.

6. Complete chemical analyses of 27 samples of red oat hay have been added to the literature on the subject.

7. Attention is invited to the possibility that depletion of bone minerals may commonly result from feeding a ration in which there is an unfavorable balance of the calcium and phosphorus content due to wide variations of these elements in red oat hay and the drinking water supplied horses.

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Further Observations on a Blood Protozoan Infection in Turkeys

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EARLY in the summer of 1938 one of the largest turkey producers in Alabama brought to the laboratory a turkey poult which had died approximately two hours earlier. He had partially dissected this fowl in an attempt to make a diagnosis. His losses had been one poult per day for the past week. The fowls died suddenly, showing no previous symptoms. The caretakers had observed two or three of these cases in which the apparently healthy fowl suddenly keeled over and died following a few convulsive movements. All losses had occurred in pens 10 by 16 feet with concrete floors, each containing one hundred birds. The pens were scrubbed daily with a 2% creolin solution and immediately flooded with water, flushing the disinfectant off completely, the birds having been removed to another pen during this procedure. Similar pens containing the same number of fowl, but with hardware cloth wire floors, had escaped losses.

The lesions were: acute swelling of the spleen, the normal color being changed to a light grey; enlargement of the liver, the surface covered with large light areas of degeneration, having the same consistency as the normal hepatic tissue, and rather sharply demarcated from the normal tissue. These areas were scattered throughout the organ. The kidneys were enlarged and congested. There was moderate bilateral edema of the lungs, and hemorrhagic enteritis throughout the length of the intestine. Direct smears and flotations from the intestinal wall and contents, made to detect parasitic infestations, were negative. Blood agar and broth cultures taken from the bone marrow and heart blood were negative. Stained blood smears revealed no abnormal features.

This infection was reported in 1938 at the American Veterinary Medical Association meeting in New York City. Four days later four more turkeys were brought in. One of them, a young tom, had died shortly before reaching the building. The hens showed droopiness, weakness, and dullness. Stained blood smears taken from the four fowl showed an enormous infestation with an organism identical morphologically with the description given in Wenyon for Leucocytozoon species. Post-mortem changes found in these fowl were identical with those found in the first poult, except that there was a marked hydropericardium, as well as marked changes resembling those of vitamin A deficiency in the upper digestive tract of the tom. Blood examination showed an average of approximately 1,900,000 erythrocytes and 40,000 leucocytes per cc, and hemoglobin 8.5mg per 100cc of blood, as determined by the Newcomer method. The total loss to date was 40 of some 2,000 fowl.

■ Our diagnosis of *Leucocytozoon smithii* was confirmed by Christenson, then with the Regional Laboratory, Bureau of Animal Industry at Auburn, Ala. The male and female gametocytes were easily distinguished. The organisms were elongated oval or cigar-shaped bodies bearing a flagellum-like process at either pole. The cytoplasm of the male cell was rather light staining. A dark band of chromatin granules extended from the base of one flagellum-like process along the cell wall to the base of the other projection. On the opposite side a similar band extended from one pole to the nucleus. The nucleus of the male stained lighter than that of the female and was somewhat less compactly arranged. The arrangement and appearance of the chromatin bands was similar in the two sexes. According to Wenyon the body, or "host cell," is a leucocyte that has been invaded by the parasite, resulting in its change of form and shape, similar to that of a cigar; the "nucleus" is considered to

be the active parasite. Comparison of fixed preparations and hanging drop preparations of the whole blood, blood laked with acetic acid, or distilled water, or diluted with physiological saline or Ringer's solution revealed some slight physical changes, probably due to fixation and staining. The parasites were on the average of five microns greater in length and three microns less in width in wet preparations than in fixed stained smears. The parasites, including the flagellum-like processes, were immotile; however, motion of the chromatin granules was observed within the nuclear structure. The width of the body at its junction with the flagellum-like processes was greater in the stained preparations than in the hanging drop preparations. In the former a distinct bulge was observed, while in the latter it was tapering. The length of the projections did not appear to vary greatly, the average length being 11.26 microns. Smears and hanging drop preparations made for comparisons were taken from the same individual and at the same time. The large mononuclear lymphocytes appeared to predominate over the other forms. Numerous degenerated leucocytes, as well as budding forms, were present.

Measurements of several of the parasites using Filar micrometer:

	Body		Nucleus		
	Length	Breadth	Length	Breadth	Sex
Average	20.15μ	10.5μ	9.07μ	4.53μ	male
Smallest	18.31	10.35	9.84	4.58	male
Largest	22.89	9.80	10.36	4.40	male
Average	20.49	10.73	9.08	4.3	female
Smallest	19.18	10.14	8.90	4.5	female
Largest	23.18	10.45	9.27	5.5	female
Erythrocytes	11.25	6.41	4.95	2.746	
Flagella-like process: average length—11.26μ					

Blood smears taken at random from 20 birds in each pen in the young flock and from all birds in the breeding flock revealed 75% infection in the former and 90% in the latter. The blood was hydremic and clotted slowly. Numerous individuals in the young flock appeared weak, dull, and lethargic, while no symptoms were observed in the breeding stock. On visits to the premises early in the morning, during the middle of the day, and late in the evening, we were unable to observe any buffalo gnats or Simulium species. There were no streams which would serve as suitable breeding places for these insects within their generally accepted flying range. A heavy infestation of lice was revealed. It was therefore suspected that possibly the lice constituted the agency of transmission, several of the Mallophaga species having recently been suspected as being capable of sucking rather than or along with biting. It was not possible to detect any of the intermediate forms of the protozoa in stained smears of the crushed lice taken from infected birds, nor can any definite conclusions be made at present from stained sections of lice. About two weeks following our visit to the farm the owner started using 5% flowers of sulphur in the mash, in an attempt to rid the fowl of the lice. No further losses were encountered during the remainder of the year nor to date which can be attributed to this infection. Numerous blood smears obtained in the fall at pullorum testing time failed to reveal one infected bird in the breeding flock, which previously had shown a high percentage of infection. The owner, having majored in biology and having a good working knowledge of insects, had not observed any of the Simulium species, even though he had taken special pains to search for them.

■ In the past two years several outbreaks of this nature have been brought to our attention from nearly all sections of the state. Last fall a turkey raiser in the east-

ern part of the state brought to the laboratory three fowl showing arthritis and distortion of the hock joints. Many of his flock were so affected. Examinations of the joints failed to reveal the so-called "slipped-tendon" changes of the condyle of the femur. Blood smears showed heavy infestations with the protozoon described. His losses had been but 15 to 20 of some 2,800 fowl. Examination of the increased synovial fluid showed the presence of numerous gametocytes. The tendons were enlarged, inflamed, somewhat contracted, and there were so-called brown mice organizations of fibrin in all the arthritic joint capsules, as well as marked periarthritis. The articular surfaces as well as the bones in general, were normal in all respects. Lesions of the chronic form were: marked congestion of the liver, with large areas of degeneration; atrophy and fibrosis of the spleen, the latter organ in nearly mature fowl being on the average of 9 by 12mm, the capsule being studded with petechial hemorrhages. The heart muscle showed petechial to ecchymotic hemorrhages, congestion, and areas of degeneration, with faulty coagulation of the blood. There was marked anemia of the lungs, catarrhal hemorrhagic enteritis throughout the intestine, and congestion and enlargement of the kidneys. The pancreas showed a reddish gray discoloration. The meninges were congested and edematous, with small hemorrhages within the brain substance. Areas of degeneration of the optic nerve were noted. Four to five days before death the humors of the eye began to become cloudy, increasing in intensity daily; the sight, however, did not appear to be affected.

Microscopic observation of the tissues of several of the acute cases, those dying suddenly and without previous indications of disease, revealed large areas of degeneration of the parenchyma of the liver, hyperplasia of the splenic tissue, edema of the interlobular tissue and alveoli of the lungs, and hemorrhages within the brain substance. Hemorrhagic catarrhal enteritis was especially well marked in the duodenum. Many of the larger vessels of the brain were occluded, mainly with large accumulations of the parasites. This was presumed to be the cause of death of the fowl showing the peracute attacks and convulsive seizures. Schizonts and merozoites were observed in the degenerated areas of the liver and spleen.

The microscopic tissue changes observed in the chronic cases were as follows: The liver was swollen, with extensive hemorrhages in the sinusoids, marked congestion of the vessels and the sinusoids, the latter being occluded by accumulations of tissue debris in large areas, and large areas of degeneration of the parenchyma, with massive infiltration of small round cells. Acute swelling of the majority of the liver cords were observed in most fowl. There was a thickening of the arterial walls, with endoarteritis. The capsule of the spleen was abnormally thickened, the walls of the blood vessels as well as the lymphatics being markedly thickened, in some cases nearly obliterating the lumen, the intima having a ragged and inflamed appearance. Subcapsular as well as deeper hemorrhages were observed. The heart muscle showed areas of degeneration, loss of cross striations, and small hemorrhages between the fibers. There were a few large areas of hyalin degeneration. The kidneys were acutely congested, with areas of intertubular hemorrhages, congestion and epithelial proliferation of the glomeruli, the majority showing crescents, marked sloughing of the tubular epithelium, and large areas of coagulation necrosis.

The walls of the vessels were thickened. The muscles of the intestine showed moderate fatty and marked granular degeneration. The villi were distorted, with sloughing of the lining epithelium, thickening and increased cellularity of the propria, and congestion of the vessels. One schizont was observed embedded in the mucosa of a villus. The lungs showed increased thickness of the alveolar walls, congestion of the larger vessels, areas of consolidation, and bronchial cuffing. The walls of the alveoli were abnormally cellular. In one case there appeared to be parasitic multiplication in the mucus gland of a larger bronchiole. Brain sections showed areas of old and partially resorbed hemorrhages, numerous

areas of round cell infiltration along the neurons of the cerebrum, cerebellum, the brain stem, and considerable distortion and degeneration of the nerve cells. The walls of the vessels appeared to be somewhat thickened. The optic nerve showed large areas of degeneration of the fibers, round cell infiltration along the entire course of the neurons, and congestion of the smaller vessels. Round cell infiltration of the retina with degeneration of the retinal cells was observed.

The mortality of the outbreaks observed by us has been comparatively low when compared to that reported by others. The symptoms observed in the acute type of infection offers no outstanding nor characteristic features other than extremely sudden death with convulsive seizures, presumably the result of cerebral occlusion. Arthritis and periarthritis observed in the chronic type of infection is of considerable economic importance in that affected fowl must be sold at a discount. These cases are apparently not related to dietary deficiencies. This arthritic change, to our knowledge, has not been reported in turkeys. Ward and Gallagher, in *Diseases of Domesticated Fowl*, report that a great number of ducks which recover from *Leucocytozoon anitis* infection are lame. Turbidity of the humors of the eyes of the chronically affected fowl and to a lesser extent of those more acutely affected, was constantly present in all fowl brought to the laboratory for observation. Macroscopic and microscopic evidences of any nutritional deficiency was absent, with the exception of possible vitamin A deficiency in one tom. The vitamin A content of the ration was increased through the addition of cod-liver oil and dehydrated alfalfa leaf meal in an attempt to increase the nonspecific individual resistance of the fowl as well as to correct any subclinical deficiency of the flock.

■ We have been unable to date to establish the turkey louse, *Goniodes meleagridis*, as a vector. There appears to be a relationship, however, between the internal and the external forms of parasitism. All fowl had an adequate exposure to direct sunlight, which is apparently necessary for best results in employing flowers of sulphur as a means of eradicating lice. The addition of 5% flowers of sulphur to the mash eradicated and controlled the external parasitic infestation. Subsequent stained blood smears from previously known infected fowl were negative. This occurred too consistently to be considered an individual problem of recovery and elimination of the parasites. Untreated fowl, those not receiving flowers of sulphur in the ration, have carried the parasites in the blood stream for as long as one and a half years. In fowl which were bled daily for observation over a four-month period the parasites appeared similar, except for a period of approximately two weeks in which the following changes were noted. Both sexes were approximately three microns less in breadth. The nucleus of the female cell became centrally located, whereas in the male it remained lateral. The cytoplasm of the male cell stained more intensely than formerly, even more intensely than was noted in the female cell. In the female cell this feature was more marked, the cytoplasm staining so deeply as to nearly obscure the centrally located nuclear structure. This change could not be attributed to a change of stain, time of fixation or actual staining period, rinsing, or differentiation. Insofar as possible the procedure was the same and a sufficient quantity of stain had been prepared at the beginning to suffice. A very few of the "normal" gametocytes were observed during this period. These peculiar or different appearing bodies disappeared rather abruptly at the end of about two weeks, and were not observed again. Another peculiarity, as yet of unknown significance, was the brilliantly staining reddish circular body, 2μ in diameter, composed of rods, and appearing between the poles and the nucleus of the erythrocytes; also the observation of rather large numbers of spindle-shaped erythrocytes, some attenuated at one, others at both poles. While it is possible that these were malarial parasites and our initial outbreak of so-called *"Leucocytozoon smithii"* was complicated with the former.

we are of the opinion that this body is one of the intermediate forms of the large spindle-shaped organism, and that instead of the latter being a leucocytozoon it is a hematozoon.

It was impossible to detect the parasite in the blood and tissues of fowl which had been dead for an hour or longer, although the protozoa survived in whole blood, blood laked with acetic acid or distilled water, diluted with physiological saline, or Ringer's solution in hanging drop preparations for several hours without alteration in form or structure.

The fertility and hatchability of the eggs from infected birds was decreased. In view of the fact that microscopic examination of these eggs did not reveal any of the parasites, the reduced fertility and hatchability was probably due to the lateness of the breeding season rather than to the protozoan infection.

■ There appear to be three types of the infection: (1) the peracute form in which apparently healthy birds die suddenly following a few convulsive seizures; (2) the less acute form with weakness, progressive emaciation, and moderate turbidity of the humors of the eye; (3) the chronic form, characterized by arthritis, periarthritis, distortion of the hock joint, lameness, and marked turbidity of the humors of the eyes.

The absence of the known vectors of the protozoa, Simulium species or the buffalo gnat, and the apparent correlation between the heavy infestation of the lice and the blood protozoa, the disappearance of the lice following the flowers of sulphur treatment, and the absence of the protozoa when tested at a later date, suggests the possibility of lice being a vector. When it is considered that various members of the Suborder Mallophaga recently have been suspected of being capable of blood sucking, even in the absence of experimental proof to date, these external parasites must be considered as a possible means of transmission. Examination of stained sectioned lice revealed pigment material, apparently hemoglobin, in the digestive tract.

Various changes in the erythrocytes would tend to open the question as to whether these parasites are leucocytozoa or hematozoa. While it is possible that these erythrocytic inclusions are malarial parasites, we do not favor this possibility. The description given for the latter parasites in various publications differs considerably from the characteristics observed by us, and the bodies observed by us did not undergo the characteristic cyclic changes. These forms are definitely not precipitation granules. The marked reduction in the number of erythrocytes as well as the change in form, that is, the large number of cells with attenuated poles occurring either at one or both poles, would indicate possibly a specific change other than that which could be attributed directly to the hemorrhage. There were no newly formed erythrocytes observed above the number found in normal fowl.

The arthritic and periarthritic changes resulting in lameness and distortion of the hock joint, fibrinous organizations within the joint capsule, with the absence of osseous changes characteristic of perosis, and with heavy infestations of the blood protozoon, in both the blood stream and the joint fluids, would indicate that these changes were probably due to the parasitic invasion. The presence of large numbers of gametocytes as well as leucocytes in stained smears of the increased synovial fluid would tend to support this statement. Sufficient quantity of manganese salt had been supplied in the mineral mixture to prevent perosis, which further confirms our assumption.

■ We are contemplating experiments dealing with the possibility of lice serving as a means of transmission of the protozoa. The effect of the addition of 5% flowers of sulphur to the mash upon the parasites within the blood stream is also to be studied. These experiments are to be started at the next outbreak when infected fowl may be obtained.

Some Observations on Bots

For the past two years I have given considerable attention to the incidence of bots in horses and their treatment, and although my study has been far from exhaustive, it may not be amiss to record some of my observations.

It should be mentioned at the outset that a majority of the post-mortem examinations I have been able to hold have been on old animals sold for meat to fox farms. Very few necropsies have been on colts or young horses.

Every animal examined post mortem, regardless of age, has been infested with bots, in numbers ranging from a few to several dozen. This is interesting in view of the fact that many of the horses treated for bots fail to pass them, according to the report of the owner. No animal that I have destroyed after treatment has disclosed a single attached bot, although in two cases, both old horses, the animal was not destroyed until 12 days after treatment. In these cases many bots were still floating in the stomach contents and all through the contents of the posterior bowel. This may explain why many animals fail to pass bots within the expected time limit.

I have not observed bot larvae attached to the duodenum or posterior bowel in the manner described in the literature. Animals examined postmortem in midsummer and autumn invariably disclose larvae attached to the stomach wall. From this I conclude that not all the larvae pass out in the spring, as has been suggested. Many of the retained larvae are attached by elongated necks, sometimes one inch in length. Such larvae are smaller than normal and appear to be almost dead.

I have a three-year record of animals treated for acute indigestion, and have made an effort to induce the owners of these animals to have them treated for bots. The results have been about 50% satisfactory. Roughly, about 60% of these animals have passed bots or worms; and of these, about 75% have escaped attacks of indigestion the following year. In a few instances I have administered a strongyle capsule either simultaneously with the bot capsule or later,

Section of a horse's stomach showing gastrophilus larvae in situ.—*Photo by F. M. Maxfield*

with excellent results. Incidentally, many owners are sincerely apreciative of an effort to assist them in this direction. They are surprised and pleased to learn that I have a record of their "colic" cases; and where the results are favorable, they become clients for yearly bot treatments.

My experience with liquid carbon disulphide capsules has been unsatisfactory. This year I used only wet mass capsules, with much better results. The liquid capsule often resulted in colicky pains and refusal to eat for several meals, particularly in old animals. No animal has given me any trouble with the wet mass capsules, either in failing to swallow the capsule or in indigestion. Instead of a balling gun, I use a rubber glove and pass the capsule with the hand, which results in very few broken

capsules and no scratches. I always make sure the capsule is swallowed.

From my experience, it seems that all horses harbor bots to some extent, and that treatment for them should be general. One reason for the disinclination of owners to treat their horses for bots is that in many instances the bots are passed so slowly following administration of the carbon disulphide that the owner observes few or none of them, and has the impression that the treatment was unnecessary. If it were possible to combine a safe cathartic with the carbon disulphide, so that the larvae would be swept out in one or two movements of the bowels, and the owner could see plainly all the bots destroyed by the treatment within 48 hours, no urging of the program would be necessary. It seems to me that this possibility merits study.

I hope to find an opportunity to administer a capsule to an unstarved animal to determine the percentage of live bots resulting from such treatment. Many animals treated have been able to eat much bedding and manger chaff; it would be interesting to note the effect of such circumstances upon the final result.

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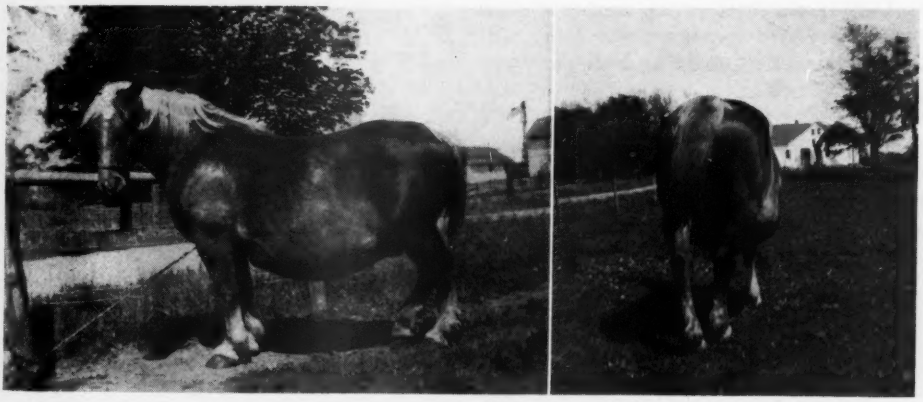
Milford, Mich.

The Only One of Its Kind

The U. S. Government Morgan Horse Farm at Middlebury, Vt., is the only farm in this country devoted to the perpetuation and improvement of a single breed operated by the United States Department of Agriculture. It was given to the people of the United States by Col. Joseph Battell, a famous Vermont horseman. The government operates other horse farms to produce and set standards for the production of remounts for the U. S. Army, but they are under management of the War Department.—*The National Horseman.*

The Exclusive Blacksmith

In 1658 the horse owners of Haverhill, Mass., were so desperately in need of a blacksmith that 20 of them subscribed $5 each, with which money they bought a house and land for presentation to John Johnson on condition that he would settle in Haverhill, do blacksmithing for the subscribers—and for no one else! At the end of seven years, the house and land became his property and he was privileged to work for whomever he cared after that. In 1639, Hampton, N. H., wanted a blacksmith so much that they offered special privileges to such a one as might settle among them.



RUPTURED PREPUBIAN TENDON IN A BELGIAN MARE

About 20 days prior to the foaling date, this registered Belgian mare, weighing about one ton, suffered a ruptured prepubian tendon which resulted in the edematous swelling shown. The pictures were taken about one week after the rupture occurred. Preparations were being made to take the foal when I was called about 4 a.m. one morning to find the mare in labor. Delivery was effected without much difficulty, but the foal was dead. The mare was given a few doses of fluid extract of ergot to contract the uterus and avert hemorrhage. She showed some unfavorable symptoms for a week, but is now in good condition except for the appearance of the abdomen especially the displacement of the mammary glands.—*Earl Ferree, Brownsburg, Ind.*

Fifty Years' Experience with Acetonemia

Acetonemia is a new name for a very old disease. When I attended college a half-century ago we called it puerperal mania. It is only within the last 10 or 12 years that we have heard of acetonemia. Fleming in his work on Obstetrics, printed in 1868, described this disease fully, saying that it affects the cow only and is marked by great agitation and sometimes fury. He also spoke of the sour odor of the feces, urine and milk, the depraved appetite, foaming at the mouth, licking the legs and chewing the manger.

Fleming cited one case in which the symptoms closely resembled those of rabies. At times this cow stretched out its fore legs, bellowed, pawed the ground with its fore feet and seemed to defy an invisible enemy. But no evidence of inoculation could be obtained. The cow was separated from the others and secured by a double chain, and an ounce and a half of chloral hydrate was given in two doses 15 minutes apart. The next day all the alarming symptoms had subsided.

Acetonemia commonly occurs a few days to a fortnight after calving. Affected animals go off their feed, milk secretion decreases by one-half or more, the animals have a perverted appetite, prefer filthy bedding to clean feed, foam at the mouth, lick their legs, and chew the manger or anything they can get hold of. The feces are hard and slimy, with a peculiar odor which is also detected in the urine and milk. Some act like milk fever victims, but do not respond to the usual treatment for that disease, or if they do respond, soon relapse.

The cause was thought in Fleming's time to be depriving the cow of her calf. Harmes ascribed the symptoms to chills which caused brain congestion, while Storrer looked upon the malady as epileptic, dyspeptic, and uterine; an excessive drain upon the system by the mammary glands was thought to cause suppression of the uterine cleansing, resulting in the peculiar smell about the animal, followed by a more or less severe attack of indigestion.

According to Udall, the essential cause is unknown, but the malady is generally believed to be due to a deranged carbohydrate metabolism, which is reduced to such a degree that oxidation of fats cannot be carried beyond the stage of aceto-acetic and beta-oxybutyric acid. This is expressed by Stevens in the statement that fats burn only in the fires of carbohydrates, and when the latter are deficient the body "smokes" with unburnt fats (ketones).

Treatment.—In Fleming's time and for 50 years later, treatment consisted of laxatives, stimulants and tonics, and, for the nervous symptoms, chloral hydrate. In view of our present knowledge of the disease, we use intravenous injections of dextrose and follow with molasses and corn. For the nervous symptoms, chloral hydrate is still the medicament of choice.

If one is doubtful of the diagnosis, all that is necessary is to apply the Hayden urine test: add one gram of a mixture consisting of one part sodium nitroprusside to 100 parts ammonium sulphate to 5cc of the urine; then 2cc of ammonia hydroxide is added and the contents of the tube mixed well, a permanganate color developing if acetone bodies are present. This test is so easily and quickly made that it should always be resorted to in cases of parturient paresis that suffer a relapse after getting up.

I shall never forget the first case of this malady I ever treated. It was in the spring of 1892. The animal was one of the crazed type with nearly all the symptoms of rabies. I dished out in my hand about two ounces of chloral hydrate and put it in a quart bottle of water and drenched her. She was in the manger, plunging around. I finally got the drench down; but most of it went into her lungs. She died right there.

Now, when I get one of the crazy ones, I simply administer one-eighth grain of hyocine hydrobromide hypodermically. It quiets the animal as quickly as chloral hydrate, and there is no danger of getting it into the lungs. I have treated some 100 animals that way. A second dose is hardly ever required.

H. FULSTOW.

Norwalk, O.

Prolonged Milk Fever Cases—Osteomalacia

Occasionally in our practice we find cases of milk fever which respond to the initial dose of calcium, then go back down to stay for a week and die. In the past year, we have had three such cases. They cause me to suspect that milk fever may have some connection with chronic nutritional deficiency and is not as we have supposed simply a metabolic disturbance. In any case I have lost three cases of milk fever from a fatal skeletal involvement which it would appear probably required at least several weeks for development, i.e., presuming the pelvic fractures were due to an abnormal fragility of the bones.

In the first case, a family milk cow, Jersey and Guernsey mixed, five years old, went down the day after calving. She showed the typical symptoms, and 500cc of calcium gluconate with dextrose was administered intravenously. This was followed with 10cc of camphorated oil intramuscularly. In a half-hour the cow was on her feet and apparently on the road to recovery. The following day she was down again. The temperature was normal and the acetonemia test was positive. She was again given the same doses of calcium gluconate with dextrose and camphorated oil, and the owner was advised to give molasses. In 12 hours the owner reported that the cow was still down. I repeated the same treatment each day, the cow remaining down. On the sixth day she died.

The next case was in a Jersey cow about seven years of age. She exhibited the usual milk fever symptoms. I administered the routine treatment and she was up promptly. Since it was wet and cold in the pasture, we drove her to the barn. The next noon I was called and advised that she had gone down again. I repeated the treatment, but she did not get up. After three doses of calcium gluconate with dextrose I wondered if there might not be a phosphorus deficiency also, and administered 250cc of calcium gluconate with phosphorus daily for four days. The cow then died, without having risen again. The acetonemia test in this case was negative the second day, but on the third day the temperature was 103°F. I performed an autopsy and found a fractured pelvis. In struggling to rise, the

Milk Fever.—*Photo by Baker*

pelvic muscles had been badly lacerated; this was no doubt responsible for the rise in temperature.

The third case was in a good Guernsey cow with her second calf. She was given the usual treatment of calcium gluconate with dextrose, followed by 10cc of camphorated oil. She arose promptly, but was down again in 18 hours. The acetonemia test was positive. I repeated the calcium gluconate with dextrose and the camphorated oil, and advised the owner to give her blackstrap molasses. After continuing this treatment for three days, with the cow remaining down, I administered 1gr strychnine sulphate hypodermically, and thereafter administered ½gr every 12 hours. When I began this treatment, I discovered a temperature of 103°F. Remembering the former case, I advised the owner of the possibility of a fractured pelvis. The cow died on the seventh day. Autopsy showed that the pelvis was split at the symphysis and the shaft of the ilium was fractured above the acetabulum.

I have talked with several other veterinarians about these cases, and they do not seem to be well understood. Have others had such cases? If so, I would appreciate their views.

F. H. CONOVER

Bloomington, Ill.

Purchase Poultry According to the Grade*

TUBERCULOSIS of poultry exists to a greater or less extent in all sections of the Corn Belt and doubtless in many other places. As an indication of the extent of avian tuberculosis, we rely upon the records furnished by the meat inspection service of the Bureau of Animal Industry, which show clearly how heavy this infection is among swine, particularly in some sections. Beyond this, competent farm inspections, including autopsies and the tuberculin test, by veterinarians of the State and Bureau regulatory forces, give further evidence that something more than has been done must be undertaken to protect the poultry and swine industries. It is unnecessary to mention that, with the suppression of tuberculosis in the ordinary farm flock, a corresponding decrease of the disease in swine should be realized.

The regulatory forces in the various states, in cooperation with units of the poultry industry and other interested groups, have outlined programs which contemplate a more intensive and effective campaign against avian tuberculosis.

The producer of poultry has never been given the incentive to eradicate disease from his flock that exists in the case of the farmer who has a tuberculous cow or one affected with Bang's disease. He has taken the loss himself. This fact partly explains why the conditions are as we find them today.

The accumulated data, available to all persons interested in the suppression of poultry disease, show the presence of tuberculosis spread quite generally over the Corn Belt. The distribution is spotted, however, by 30 to 60% flock infection and as high as 14% bird infection in some localities to as low as 2% bird infection in others, with a corresponding reduction in flock infection. Of course, we realize that many diseases are susceptible to certain prescribed treatments, such as raising the chicks on clean ground, marketing the old fowls at suitable periods, and observing other well-known precautions, the keynote of which is that no fowl will live and develop satisfactorily in too close association with its own excreta.

In certain sections throughout the country there are establishments where poultry is processed and this practice is spreading. With the evisceration and inspection of poultry, it is logical to assume that there will be less outlet for the diseased and undeveloped fowl. When such condition arises, packers will be compelled, in self-defense, to buy strictly upon grade with the obvious results that the producers will anticipate more clearly the needs of the market and raise birds accordingly.

The marketing of birds has been somewhat handicapped by the consumers' knowledge, gleaned from personal experience, that poultry in many instances has been found to be infected with tuberculosis. The processing of poultry under competent inspection should tend not only toward the control of disease but also toward the stimulation of consumer demand through increased confidence in the wholesomeness of the product.

The large packer of poultry looks to a long-time program and will agree to buy strictly upon grade, but ofttimes in certain localities he encounters the competition of small and possibly itinerant buyers and meets their prices. Thus the fowl that should have been burned upon the farm as a cull is marketed for food. The greatest control available is the buying of poultry on grade.

There is, without doubt, a general awakening to the consciousness that in defense of the industry the suppression of poultry diseases is essential. The extension of information on disease and sanitation through poultry clinics, held by veterinarians in the presence of the producer of poultry, where the latter can see his birds taken apart and note the process of disease or presence of parasites, is doubtless one of the most convincing means of attaining progress in disease control. Beyond this, meetings, at which producers, hatcherymen, and processors hear talks by competent persons and see charts illustrative of disease and its damage, with available literature in other instances, should do much to decrease disease among poultry. We have already drawn

*Presented at the 43rd annual meeting of the U. S. L. S. S. A., Chicago, Dec. 6-8, 1939.

attention to the effect that the processing of poultry, under competent inspection, would have on disease suppression. The present may or may not be the time for this.

I believe that at this time all persons whose duty it is to endeavor to bring about a more healthful condition among poultry, feel that the right course is being pursued and that the machinery, which has been set up for some time and improved with increased knowledge of necessity and experience, will be instrumental in reducing disease materially from year to year.

J. P. SIMONS.

Des Moines, Ia.

* * * *

An Embryonal Adenosarcoma of the Kidney

A beagle was brought to me for diagnosis. The animal appeared normal in all respects except for an enlarged abdomen. The temperature was 101.6°F., respirations 30, and pulse 120. He was six months old, bright in appearance, and with no abnormal history other than that of the enlarged abdomen, which had been first noticed when he was about two months old. A hard mass which nearly filled the abdominal cavity was readily palpated. I presumed that it was a neoplastic growth, probably a teratoma, and advised surgical removal. The owner, however, decided to wait a week or so.

About ten days later the owner advised me that the animal had died. The night before he had seen the dog fall from the basement steps, a drop of three or four feet. He watched it for a few minutes; it walked around and appeared normal, but the next morning was dead. The body was presented for autopsy that evening.

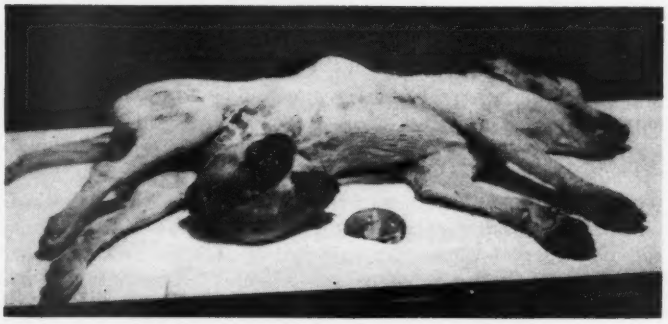
Post-mortem examination revealed an enormously enlarged kidney. This mass measured about 24½ inches in circumference and weighed two pounds ten ounces. The opposite kidney appeared normal. The color of the affected organ was a dark red. The capsule was ruptured for some eight to ten inches and showed what appeared to be pustular foci in the deep red kidney tissue. The capsule was easily removed. Growing from the pelvis of the kidney there was a pale, papillary cellular growth which seemed to stretch the kidney tissue over its summit in certain areas and did not appear to be deeply infiltrative. Death was due to hemorrhage from the ruptured organ, incurred in the fall from the steps.

Microscopically the mass was made up of an extremely cellular type of growth mixed with which were fibroblastic and round cell types which were extending into and invading the kidney tissue. Blood vessels were numerous and dilated; considerable hemorrhage was observed. The tumor showed an invasive tendency in all directions.

The diagnosis of the laboratory technician was embryonal adenosarcoma of the kidney —the so-called "Wilm's tumor." This type of growth is more commonly seen in children. It is a malignant neoplastic formation which is probably teratoid in nature, and arises by the simultaneous segregation of nephrogenous and muscle tissue at a very early embryonic stage.

W. H. MOWDER.

Independence, Mo.



The animal described in this report. On the left is shown the enlarged kidney; on the right, the tumor

Abnormal Parturition

Case No. 1.—A purebred English setter bitch had been considered an outstanding shooting dog in her younger days, and the owner wished to obtain another litter of pups from her; he therefore had her bred, hoping she was not too old to carry the pups to term. She was bred twice to the same sire (March 17th and 21st).

She remained in good health through a normal gestation period, but whelped only two pups, both dead, on May 19th—either 59 or 63 days from the time of service. For several days following parturition she showed symptoms of some abnormality. Her hair coat became roughened, considerable loss in weight was noted, and she appeared generally run down, but there was no rise in temperature. Eleven days following parturition (May 30th) she was given 1cc of pituitary extract. Much to the surprise of everyone, on June 1st she whelped three viable pups. At the latest report these pups were still living, and were accepted for registration in the A. F. D. S. B., although after considerable controversy.

The next heat period she was again bred, this time whelping one normal pup the 63rd day following service.

The easiest explanation for the peculiarities in this case is uterine disease, indicated in the first pregnancy by the abnormally long period of gestation. Uterine disease commonly modifies the duration of pregnancy, sometimes prolonging it, sometimes shortening it. In the second pregnancy, the delivery of only one pup is again somewhat indicative of genital infection.

Case No. 2.—A toy bitch weighing only 3½ pounds was presented at the hospital four days after parturition should have occurred. During a previous heat period she had been bred, and during the days that followed she showed every sign of pregnancy. On the 63rd or 64th day of pregnancy she showed signs of weak labor. The labor pains ceased within 24 hours. No further signs of parturition were noticed, and the enlarged abdomen gradually returned to normal. At the next period of estrum she was bred again, and was presented at the hospital 68 days later. After the administration of ½cc of pituitary extract gave no beneficial results, cesarean section was performed.

In the left horn of the uterus a large, fully developed fetus was found dead. This fetus weighed 4.7 ounces. In the right horn there were three small fetuses, fully developed even to the presence of hair, but in a mummified condition; together they weighed only 3.2 ounces. They were still enclosed within the allantois, but surrounded by a thick, greenish, cheesy substance.

Either this was an instance of superfetation, or the first pregnancy was a pseudocyesis. No proof can be given of either theory, but the latter seems the more likely. In either case, there is evidence of genital disease in this case also.

B. M. CARNES.

Henryetta, Okla.

* * * *

Copulation After Spaying

April 10, 1940, a black, one-year-old Boston terrier weighing 15 pounds, was presented for hysterectomy. The owner stated that the bitch had been in estrum for the past seven days and that he did not want to have her bred; nor did he want to be troubled watching her during the period of estrum.

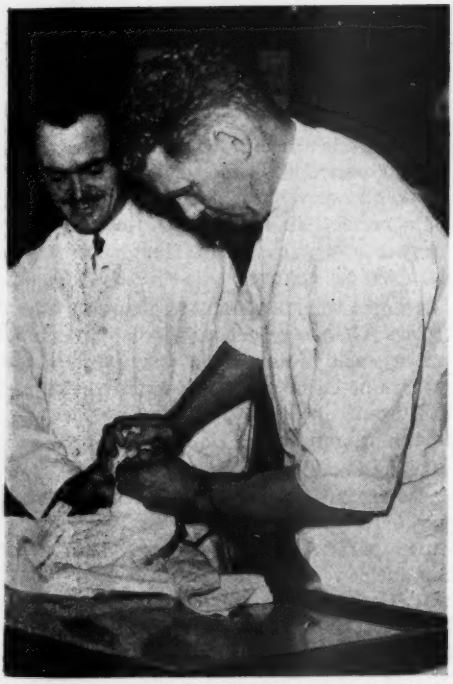
The bitch was prepared for the operation, general ether anesthesia being used. An incision was made through the abdomen on the median line, and both ovaries and the horns of the uterus were removed as far back as the bifurcation. The blood vessels were ligated with 20-day chromic catgut and the abdominal incision was closed with a braided silk suture. An antiseptic pack and bandage were applied, and the owner took the animal home. (Such cases are usually sent home after they have recovered from the anesthetic. Owners are instructed as to the care and feeding of the animals; and the bitch is brought in on the fifth day for removal of the stitches.)

April 13th the bitch was turned out in the yard for exercise; about one hour later the owner found her in the act of copulation. The male dog was a fox terrier weighing approximately 20 pounds. Before he could separate her from the male she collapsed.

The owner rushed her to the hospital, where she showed the following symptoms: anemic mucous membranes, muscular weakness and tremors. The condition was diagnosed as shock. Treatment consisted of intravenous injection of 100cc of a 5% solution of dextrose and physiological saline solution. The following day the bitch was well enough to go home.

April 20th she was again presented with a vaginal discharge. The owner described it as being of a purple color when first noticed, later changing to a light straw color. On the day the bitch was brought in the discharge was red and consisted primarily of blood cells. Treatment consisted of irrigating the vagina with physiological saline solution. The owner was instructed to bring her back if the discharge continued. May 20th he reported that the discharge had not reappeared and that the bitch seemed to be in good health.

Few cases of this kind have been reported.



Wrapping or rolling a cat in a heavy towel is excellent as a means of restraint for work on either end. Dr. E. J. Frick is shown examining a cat's mouth at the Omaha Clinic of the A. V. M. A.

Copulation occurred 85 hours after the operation. According to the literature, hormones of estrum remain in the blood stream for seven days following the removal of the ovaries.

HORTON K. HOWARD.

Canton, New York.

* * * *

Estrum in the Cat

In the cat, estrum is manifested by a marked playfulness, caressive movements of the head, and rolling. As the climax of estrum approaches, there is a congestion of the external genitals and an attraction for the male. The female frequently assumes a sterno-recumbent position with elevated pelvis. The tail is raised and twitches, and a treading movement of the hind feet is apparent. During this stage of estrum a low sound is emitted that is heard at no other time. The cat rolls playfully at the feet of the male and accepts him when these symptoms are evident.

The majority of females have three heat periods a year, commonly occurring in the months of February, June, and October. Frequency of estrum is influenced to some extent by environmental conditions, nutrition being perhaps the most important. Excessive heat periods are probably due to endocrine malfunction; or they may appear in the absence of coitus. Cats which are isolated have recurrent estrum at 14-day intervals. The duration of estrum is from two to three days.

Ovulation in the cat is a neurohormonal process induced by vaginal stimulation, and is, therefore, dependent upon coitus. Copulation is followed in 24 to 27 hours by ovulation, four ova being the average number liberated. Pseudopregnancy follows sterile coitus, terminating in about 30 to 35 days, during which time the motility of the uterus is markedly decreased, probably due to the activity of the corpus luteum of estrum. True pregnancy is of an average duration of 60 days with a normal variation of 56 to 63 days, and is followed by anestrum, a period of sexual inactivity prior to the next estrual period.

PAUL E. PHILLIPS.

Ottawa, Kans.

"Heart Failure" in a Dog

The cost to man of civilization and the increased tempo of life has been a marked increase in sudden death from "heart failure" during the middle-age years. Now, it would appear, the dog must pay the piper too.

On the evening of August 28th a routine examination of a patient was abruptly interrupted by an agitated voice from the reception room:

"Doctor! Can you come here at once and tell me whether this dog is dead?"

Picking up a stethoscope on the run, I rushed into the reception room to find a Scottish terrier draped lifeless across the table. A glance was sufficient to ascertain that we were looking at a corpse, but to placate the excited client I adjusted the stethoscope to my ears and sounded the animal's thorax for any bruits of life.

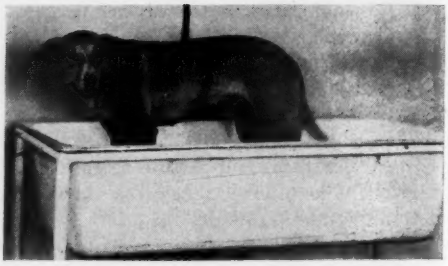
"Dead!" I pronounced solemnly.

"What caused his death?"

"That I could determine only by autopsy —and perhaps not even then."

After a moment of deliberation the man consented to the autopsy. The history was negative. The dog, five years of age, had been in apparently perfect health. About one-half hour before presentation he had reared to put his forepaws on his master's lap, but, instead, fell over limp with nary a kick nor murmur.

The autopsy unfolded before us a veritable museum of pathology. A minor degree of ascites made itself evident by a gush of serous fluid immediately the abdominal cavity was incised. The liver was completely cirrhotic—surface entirely roughened, color pale, consistency hard—and its normal or slightly enlarged size indicated the condition to be a hypertrophic cirrhosis. The kidneys revealed a chronic nephritis, as shown by diminution in size, paleness and adherent capsule. The only discordant note in this picture of chronicity was an acutely hyperemic intestinal tract. The stomach, small intestine, colon and rectum were uniformly inflamed. However, considering the absence of inflammatory exudate in the intestines and the negative bowel history, we relegated these findings to the category of effect rather than cause.



A tub such as this is a convenience in the treatment room

Interesting as the abdominal viscera were, it was the thoracic cavity that presented the highlight of the autopsy. The lungs were negative, aside from the mild degree of anthracosis common to city dogs. The heart, however, was thoroughly abnormal. Pericarditis was manifested by the presence of an ounce or two of serous exudate in the pericardial sac, but this bit of pathology was overshadowed by the condition of the ventricular walls. The consistency of the walls approached that of the tread surface of a rubber tire. Upon incision they were found to be markedly hypertrophied, the thickness of the right ventricular wall being about one-half inch, while that of the left was fully one and one-half inches. The walls were hypertrophied to such a degree that the ventricular chambers were reduced to little more than slits. No *D. immitis* were present and the endocardium showed no pathological changes.

Examination of teeth, tonsils and other tissues failed to reveal any focus of infection which could account for the pathological picture of chronic tissue damage. Evidence of chronic chemical poisoning was lacking in the anamnesis.

The probability exists that the underlying cause of death was a chronic nephritis leading to a progressive degeneration of the other parenchymatous organs. The more romantic verdict, however, and the one which catches our fancy is: Death caused by heart-failure in middle-age, due to chronic hypertrophic myocarditis attributable to the vicissitudes of civilization.

What do you think?

J. GEORGE FEINBERG

Norfolk, Va.

Acute Alcoholism in Nine Dogs

Acute alcoholism, although frequent in man, is rare in animals and even more rarely seen in more than one individual at a time. Nine birddogs in various states of intoxication seem to constitute a case worth reporting.

I was awakened by the frantic ringing of

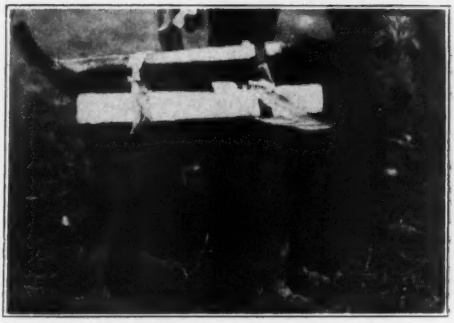
the telephone at 1 a. m., September 16, 1940. A kennelman 14 miles away was calling to say that several of his boarders, all valuable dogs, had eaten a 10-gallon lard can full of soured cake dough. He said he would be right down, and he arrived in 20 minutes with five dogs.

One pointer had lost consciousness. The others were in various states of intoxication. Each was given 0.1gr. of apomorphine. Two were given it hypodermically; for the other three the pill was crushed and placed under the upper eyelid.

After what seemed a long two minutes all five vomited large quantities of thin sour dough. There was no difference in the time of action between the two methods of administration. I then gave each dog a thorough irrigation with cold water. They were very sick for about 20 minutes, then fell into a deep drunken sleep.

The kennelman then stated that he didn't know how many more were sick, as he had brought only the worst ones. The sleeping five were loaded into the back of his truck and I followed him to the kennel. We both thought that a cool ride in the night air would help. This remembrance from college days, however, didn't work on dogs.

Upon arrival at the kennel we found four



These dogs were also innocent victims of "the vicissitudes of civilization." The patient shown above is recovering from an automobile accident in which he suffered fractures of the thoracic vertebrae. The dog at the left, "Bozo's Marol Binker," achieved a modest degree of fame as the first canine victim of carbon monoxide poisoning reported in veterinary literature (*Vet. Med.* 33:2, page 67)

more reeling around like drunken sailors. They were given apomorphine. After vomiting and retching they too drifted into a deep sleep. The nine patients were then laid out in a row and covered with blankets. The kennelman wasn't as sure as I was that they would recover. I left at 4 a. m., leaving instructions to report anything unusual.

At 8 a. m. all were recovering nicely except the pointer which had lost consciousness first. He was again brought to the office. He had apparently eaten more dough than the rest and it was forming gas in the intestines. He was bloated so badly that the outline of his intestines could be felt through the walls of the abdomen. Enemas and massage failed to relieve him. I gave another 0.1gr of apomorphine, with no results. I followed this with a third dose. In 20 minutes he vomited and his bowels moved, freeing the gas. I then gave him an injection of glucose. At 6 p. m. he regained consciousness. The following morning he was normal and was taken back to join his mates, who had made an uneventful recovery.

G. W. BAYLES.

Marion, Ill.

Abstracts

Value of the Periosteum in Bone Grafting

Different authorities have held conflicting opinions concerning the role played by the periosteum in bone grafting operations. The authors[48] carried out operations in which bone grafts with the periosteum retained and others in which the periosteum was removed were applied to the opposite femurs of the same dog. Radiologic and microscopic studies were then made to determine the relative success of the two types of graft.

Radiologic study of five dogs showed that in the case of the leg where the periosteum was removed, one graft was completely absorbed and the other four partially so. On the other leg, where the periosteum was retained, three grafts were completely absorbed and two partially so.

Microscopic examination of specimens removed from the femurs of seven subjects showed that in those cases where the periosteum had been removed, a fibrous periosteum had developed from the surrounding connective tissue. In four of these cases the inner layers of this fibrous periosteum showed evidence of a more cellular development or of the formation of new bone. The grafts in which the periosteum had been retained included only one in which there was any active development of the periosteum with production of new bone, although a second showed a minor degree of periosteal activity. In three cases, the periosteum was inactive or absent.

From these findings, one would conclude that no advantage is gained by the retention of the periosteum in bone-grafting operations; in fact, it appears that removal of the periosteum actually results in the production of a more active periosteum from the surrounding connective tissues. This may have been due to the fact that scarification of the surface in the removal liberated osteoblasts from the graft itself.

[48] Pollock, G. A., and M. S. Henderson, 1940. The value of the periosteum in bone grafting operation. *Proc. Staff Meetings Mayo Clinic* 15:28, pp. 443-448.

Bang's Disease Eradication

The status of Bang's disease eradication and the benefits to be derived are summarized as follows.[43]

The cooperative federal-state program of eradicating Bang's disease is effective in freeing both dairy and beef herds of the disease.

Although producing satisfactory results when testing is conducted on an individual herd basis, the program is still more effective and meets with greater favor among most cattlemen when herds are tested on a countywide or area basis.

Even in badly diseased herds, systematic retesting, combined with good management practices, may be expected to result in the practical eradication of the infection within about four tests.

Success in eliminating Bang's disease by the use of the agglutination blood test compares favorably with the success attained in eliminating bovine tuberculosis with the tuberculin test, both tests being used as a means of diagnosis. Typical benefits reported by cattle owners participating in the Bang's disease eradication program include:

Thriftier condition of herds.

Calf crops, in both beef and dairy herds, approximately 20% to 25% greater than formerly.

Material increases in the milk production of herds, depending largely on the number of diseased cows replaced by healthy ones. Noticeable decreases in numbers of cows affected with udder troubles and sterility.

Great marketability of breeding stock and better prices because (1) purchasers are becoming more and more insistent on disease-free sources of animals, and (2) state legislation restricts the entry of untested breeding stock.

Greater marketability of dairy products because of legal restrictions, imposed by states, cities and towns, on products from untested herds.

Greater safety to human health because of the fact that raw milk from herds infected with Bang's disease may transmit undulant fever.

[43] Mohler, John R., A. E. Wight, and Elmer Lash. 1940. Benefits of eradicating Bang's disease. U. S. D. A. Misc. Pub. No. 384.

Investigation of Immunologic Properties of Rabies Vaccines

An investigation[49] of the immunizing power of the various strains of rabies fixed virus now being used in the manufacture of rabies vaccine seemed indicated in view of Webster's report that of 33 rabies vaccines purchased on the open market and tested in mice, only two showed any immunizing ability.

Marked variations were found in the properties of 25 substrains of rabies virus derived from the original Pasteur strain. Immunizing power of the strains seemed related to their ability to resist phenol, to the rapidity of their passage transfer, and possibly to the length of the incubation period in rabbits. High immunizing potency is not an inherent characteristic of any particular strain, but apparently can be increased or decreased during its passage transfers over a long period of time. Laboratories manufacturing rabies vaccine should therefore investigate the properties of their rabies fixed virus periodically.

Slight or no immunity (0-25 m.l.d. protection) was given by phenolized vaccine from 12 viruses, moderate immunity (25-100 m. l. d. protection) by 10 viruses, and a high degree of immunity (100+ m. l. d. protection) by nine. The highest immunity produced was against at least 2,000 m. l. d.

The experiments showed that as far as phenolized vaccines are concerned (15 of the strains are now used to manufacture phenolized vaccines) the various strains of rabies fixed virus differ markedly in their immunizing potency even though derived from the same parent strain. The need of establishing a strain of high immunogenic value for use in manufacturing rabies vaccines for human or animal use is obvious. There need be no excuse for marketing vaccines known to have poor or even no immunizing power. However, suppose we were to determine the strain that is the most immunizing and supply it to all laboratories making rabies vaccine. We would have no assurance that five years, or even one year later those substrains would all still be highly immunogenic. In other words, owing to the manner in which the virus might be handled in different laboratories, the evolution of the strain might very well be toward less and less immunizing potency.

Therefore, a very important part of the problem is the determination of how to build up and maintain the immunizing value of a fixed rabies virus strain. Work directed toward answering this question is now in progress and will be published at a later date.

[49] Habel, Karl, 1940. Factors influencing the efficacy of phenolized rabies vaccines. I. Strains of fixed virus. *Public Health Reports* 55:36, pp. 1619-1631.

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The Control of Trichinosis

The following safeguards should be used for the control of trichinosis:[44]

1. The public should be informed of the danger of trichinosis and taught that insufficiently cooked food containing any pork is dangerous.

2. The least likely source of trichina infection is pork products prepared under federal or adequate municipal supervision. It is the unprocessed pork products, especially summer sausage, prepared without supervision in small local slaughterhouses or on farms, that most frequently cause trichinosis. The jurisdiction of public health organizations should therefore include these sources of pork products.

3. The packer and the swine grower have it within their power and should be given the responsibility of setting up safeguards against the sale of infested pork by excluding the hog which is fed uncooked pork scraps.

4. The medical profession should keep in mind the possibility of the disease when unusual cases of influenza or grippe do not respond readily to treatment. If the physician suspects the disease, the diagnosis can be made readily. All cases should be reported to the health department and attempts made to discover the source of the parasite.

5. While the immediate responsibility for contracting the disease rests upon the consumer, the United States Public Health Service should assume the chief role in protecting the public from it.

[44] Murphy, F. D:. H. D. James, and J. W. Rastetter, 1940. A study of 23 cases of trichinosis. *Am. Jnl. Med. Sci.* 119, p. 328.

Treatment of Mange in Animals

The method of treating mange by the application of sodium hyposulphite and hydrochloric acid was first used on animals in 1933.[51] The procedure which has been formulated for the treatment of mange in horses has proved efficacious for all varieties of mange (sarcoptic, psoroptic and chorioptic).

The stages of this method of treatment are as follows:

1. Clip the horse, removing all long hair.
2. Wash with soap and water to remove scabs.
3. Friction of the whole body with a brush dipped in a 60% solution of sodium hyposulphite. This stage takes 30 minutes when carried out by one man.
4. Allow the horse to dry for about two hours. A white deposit of fine crystals of hyposulphite forms on the coat.
5. Friction with a brush dipped in a 10% solution of commercial hydrochloric acid, which also takes 30 minutes.
6. When the horse is dry the above two dressings are repeated.

This concludes the first phase of the treatment. Two or three days later the treatment is repeated. If the mange is very advanced, a third treatment two or three days after the second is required. In mild cases of mange, a cure immediately follows the first phase of the treatment and after three days the horse can be washed with water.

The success of the treatment depends largely on the care with which it is carried out. When the horse is dry it is necessary to make sure that the whole of the body has been treated, as judged by the white deposit. Any places which have been missed must be redressed.

Each dressing takes about three pints of each solution.

Horses like the treatment and respond to the friction of the brush. The irritation of the skin disappears on the day following the treatment. Injury to the skin or to the general condition of the animal has not been observed. Analysis of the blood and urine has not shown any change.

This method of treatment of mange has been employed on an extensive scale by many collaborators — Agromuk, Khatime, Nenukor and others, who confirm the efficiency and harmlessness of the method. Today this method of treatment is extensively used in the U. S. S. R., with good results.

The method has been employed during the winter months and we found that it could be used in the winter, provided it is carried out indoors where the temperature is not lower than 46°F.

The chemical action which takes place is as follows:

The hyposulphite of soda under the action of hydrochloric acid is broken down to sodium chloride, water, sulphur dioxide and sulphur, and the chemical reaction is as follows:

$$Na_2S_2O_3 + 2HCl = 2NaCl + H_2S_2O_3 = 2NaCl + H_2SO_3 + S = 2NaCl + H_2O + SO_2 + S$$

That is to say, there is first formed sodium chloride and thiosulphuric acid and afterwards the thiosulphuric acid is reduced to sulphurous acid and sulphur, and then the sulphurous acid forms water and sulphur dioxide.

Some of the elements formed by the breaking down of the hyposulphite have a powerful acaricide action, due to the sulphur dioxide and sulphur liberated, although it may be possible that the intermediate products are also acaricides.

Afterwards the newly formed sulphur is transformed under the action of oxygen and moisture into thiosulphuric acid, which in turn is converted into sulphur dioxide and free sulphur. This action is represented by the following formulae:

1. $S + 2O = SO_2$; $SO_2 + H_2O = H_2SO_3$; $H_2SO_3 + S = H_2S_2O_3$

2. $H_2S_2O_3 = H_2SO_3 + S$; $H_2SO_3 = H_2O + SO_2$, etc.

The experiments of Rodionov show that under laboratory conditions the sulphur is active on sarcoptes for two or three days, after which it becomes inert.

A study of the action of sulphur has led Rodionov to think that the toxic action of sulphur on sarcoptes is due to the thiosulphuric acid.

Thus by this method of treatment a se-

[51] Demianovich, 1937. *Office International des Epiz Bulletin*, 14. Abst. in *Jnl. of the Royal Army Vet. Corps* 11:2. pp. 62-63.

ries of substances are produced which are very active acaricides (sulphur dioxide, sulphur and thiosulphuric acid).

In conclusion, although this method of the treatment of mange has shown its high efficiency and complete harmlessness in both medical and veterinary practice it is necessary to say that it is not considered that the details of the study of the subject are yet completed. There is still work to be done on the improvement of this method of treatment of the many different forms of mange of the different animals and in the treatment of other forms of parasitic skin diseases caused by fungi and bacteria.

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Effect of Mineral Oil on Calcium and Phosphorus Metabolism

The effect of ingestion of mineral oil on the metabolism of calcium and phosphorus was studied in rats by comparing the ability of vitamin D fed as cod-liver oil to calcify rachitic lesions in the presence and absence of mineral oil; in dogs by comparing the retention of calcium and phosphorus by means of a series of weekly balance studies in mineral-oil-fed and non-mineral-oil-fed puppies.[47]

In the rats, the mineral oil interfered with the utilization of the vitamin D to such an extent that three times as much cod-liver oil was necessary to induce healing of the rachitic lesions when the basal ration contained 5% mineral oil, and between five and ten times as much when it contained 10%.

In dogs, mineral oil ingestion interfered with the retention of both calcium and phosphorus so seriously that normal calcification of the bony structure was not possible, the mineral-oil-fed dogs developing severe rickets even though receiving adequate amounts of calcium and phosphorus and a minimum protective dose of cod-liver oil. Increasing the amount of cod-liver oil improved the situation, but did not provide for optional retention of the mineral elements, even when the oil was increased fivefold.

[47] Smith, M. C., and H. Spector, 1940. Calcium and phosphorus metabolism in rats and dogs as influenced by the ingestion of mineral oil. *Jnl. Nutrition* 20, pp. 19-30.

Prevention of Conception in Bitches by Injections of Estrone

Prevention of conception and termination of pregnancy by injections of the estrus-producing hormone have been demonstrated in the albino rat, the white mouse, and the guinea pig. The oral administration of certain estrogens have prevented conception in the rat and in the rabbit. The prevention of conception in larger animals by these or similar methods has not been reported previously.

The authors[50] administered the estrus-producing hormone to 11 animals, beginning not later than the second day following copulation. They used injections of theelin in six and of amniotin in five animals. Nine of the animals were given one ampule (2,000 I. U.) daily for six days, making a total of 12,000 I. U. administered; the other two were given two ampules daily for the same period, a total of 24,000 I. U.

Six of the 11 animals injected had no puppies. Of the five in which conception occurred, one had eight puppies, two had four, one had two, and one had one. These were, in general, the heavier bitches receiving the smaller dosage of the hormone. The bitch producing eight puppies was the heaviest of the lot (60 pounds). The two animals receiving the doubled dosage produced no offspring. The authors conclude that inadequate dosage was responsible for the failure to prevent conception in the five animals which produced puppies.

On the basis of their results, the authors recommend the following dosage of the hormone for the prevention of conception in bitches: 500 I. U. per pound of body weight, giving in no case less than 10,000 I. U. even in very small dogs. Using the preparations in oil, the hormone may be given more conveniently in two or three injections, rather than daily for six days as in this experiment. Such preparations may be obtained from biologic supply houses.

Further data on the use of this hormone for the prevention of conception in bitches are necessary. However, the authors state that use of the recommended dose is almost certain to produce satisfactory results.

[50] Kelly, G. Leonard, and Leon F. Whitney, 1940. *Jnl. of the Med. Asso. of Georgia.*

Book Reviews

Veterinary Surgery Notes. *By E. R. Frank,* B.S.A., D.V.M., M.S., Professor of Surgery, Kansas State College. Revised Edition. Flexible leatherette binding; 255 pages, 106 illustrations. Burgess Publishing Co., Minneapolis, Minn., 1940. $5.00.

This text, which is printed on the planograph but deserves better handling, is, as the title implies, notes on surgery rather than a complete treatise on the subject. It is obviously intended primarily for the use of veterinary students and to be supplemented by lectures and surgical exercises.

The practitioner, however, will find it useful as a brief, concise exposition of all the ordinary and most other veterinary surgical operations. The illustrations are a particularly valuable feature. In many instances interest is added to the discussion by a brief report of the actual case illustrated.

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Care of the Dog. *By Will Judy,* Editor of *Dog World.* Cloth bound; 96 pages, 71 illustrations. Judy Publishing Company, Chicago, 1940. $1.00.

Of recent years there has been an uninterrupted flow of books about dogs from the presses of publishers. There seems to be an impression among book publishers that any book about dogs will sell. A result has been a good many that add nothing of value to the literature about this extremely popular animal. Captain Judy's latest work does not fall in that class. It is concise, sticks to the subject announced in the title (a thing few dog books do) and is pleasingly written.

Care of the Dog comprises 38 chapters and discusses selection, housing, housebreaking, feeding, training, shipping, nursing and first aid in illness or accident. It counsels the early resort to skilled veterinary service when indicated and has an illustration for nearly every page to emphasize the importance and impress upon the memory statements of particular significance. It is a book the veterinarian can recommend to the new dog owner, or even to the more experienced, with confidence.

Dutch Vet. *By A. Roothaert.* Translated from the Dutch by Fernand G. Renier and Anne Cliff. Cloth bound; 437 pages. The Macmillan Company, New York, 1940. $2.50.

Dutch Vet is better than the title. It is a good story well told by any standard and being about a veterinarian and his work, it is unique in American fiction.

The story is about "Dr. John Vlimmen," a veterinary practitioner in the south of Holland. The reader is taken with him on his calls, watches his surgical operations and is initiated into his work in meat inspection. The terms used, the symptoms detailed and the descriptions of the operations are remarkably accurate technically. Only one material error is noted—crediting Sjollema instead of Greig with the discovery of the usefulness of calcium in parturient paresis.

Sufficient sex and filth are scattered through the work to make it palatable to the public's taste in reading. It treats the veterinarian's calling with dignity and understanding and should serve a useful purpose in cultivating a better appreciation for veterinary medicine. After a series of petty annoyances and major difficulties, Doctor Vlimmen finally achieves a spiritual equilibrium, for "much would happen to him, but there remained one great value, something he possessed and which could not be taken from him—his hard, honest and fine profession."

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Kansas Association Report

The Proceedings of the 36th Annual Convention of the Kansas Veterinary Medical Association have been published in a 126-page paper-bound book compiled by the secretary, Dr. Chas. W. Bower. In addition to the lists of officers, committees, and membership; the constitution, by-laws and code of ethics of the association; the reports of the State Board of Veterinary Examiners and of the various committees of the organization; and the business transacted at the meeting, the book contains the full text of the papers presented, by Drs. L. A. Merillat, W. C. McConnell, B. C. Harrison, H. W. Young, A. H. Quin, and N. D. Stanley, together with the discussion that followed each paper.